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(21) International Application Number: PCT/US90/07417 (22) International Filing Date: 27 December 1990 (27.12.90) (30) Priority data: 463,356 11 January 1990 (11.01.90) US 542,390 22 June 1990 (22.06.90) US (60) Parent Applications or Grants (63) Related by Continuation US 463,356 (CIP) Filed on 11 January 1990 (11.01.90) US 542,390 (CIP) Filed on 22 June 1990 (22.06.90) (71) Applicant (for all designated States except US): E.I. DU PONT DE NEMOURS AND COMPANY [US/US]; 1007 Market Street, Wilmington, DE 19898 (US).		(72) Inventor; and (75) Inventor/Applicant (for US only) : ARTZ, Steven, Powell [US/US]; 225 Potomac Road, Wilmington, DE 19803 (US). (74) Agents: GREGORY, Theodore, C. et al.; E.I. du Pont de Nemours and Company, Legal/Patent Records Center, 1007 Market Street, Wilmington, DE 19898 (US). (81) Designated States: AT (European patent), AU, BE (European patent), CA, CH (European patent), DE (European patent), DK (European patent), ES (European patent), FR (European patent), GB (European patent), GR (European patent), IT (European patent), JP, LU (European patent), NL (European patent), SE (European patent), US . Published <i>With international search report.</i> <i>Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.</i>
(54) Title: HERBICIDAL PYRIMIDINES AND TRIAZINES (57) Abstract This invention relates to certain herbicidal sulfonylure pyrimidines and triazines useful for complete control and/or selective control of vegetation with the selectivity being important to agronomic crops.		

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TITLE**5 HERBICIDAL PYRIMIDINES AND TRIAZINES****Related Applications**

This is a continuation-in-part of U.S. Serial
No. 07/542390 filed June 22, 1990 which is a
continuation-in-part of U.S. Serial No. 07/463,356
10 filed January 11, 1990.

Background of the Invention

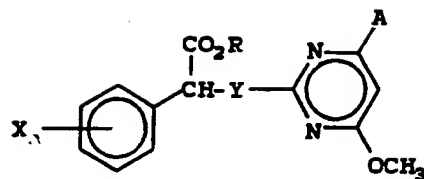
This invention relates to certain herbicidal
pyrimidines and triazines, agriculturally suitable
compositions thereof and a method for their use as
15 general or selective preemergent or postemergent
herbicides or as plant growth regulants.

New compounds effective for controlling the
growth of undesired vegetation are in constant
demand. In the most common situation, such compounds
20 are sought to selectively control the growth of weeds
in useful crops such as cotton, rice, corn, wheat and
soybeans, to name a few. Unchecked weed growth in
such crops can cause significant losses, reducing
profit to the farmer and increasing costs to the
25 consumer. In other situations, herbicides are
desired which will control all plant growth.
Examples of areas in which complete control of all
vegetation is desired are areas around railroad
tracks, storage tanks and industrial storage areas.
30 There are many products commercially available for
these purposes, but the search continues for products
which are more effective, less costly and
environmentally safe.

JP Kokai Hei 1[1989]-301668 discloses mandelic
35 acid derivatives as herbicides:

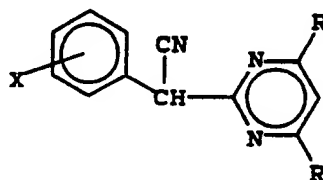
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J. Chem. Res.(S) 1977, 186 discloses benzyl
pyrimidines as intermediates to herbicides but
includes no herbicidal test data for these
intermediates.

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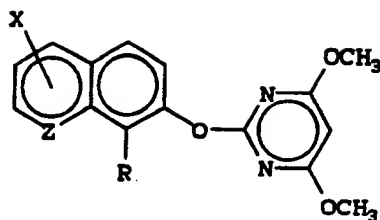
JP KOKAI HEI 2[1990]-56469 (unofficial English
translation) discloses as herbicides the following
structures:

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wherein, inter alia

Z is CH or N;

R is a formyl group or CO_2R^1 ; and

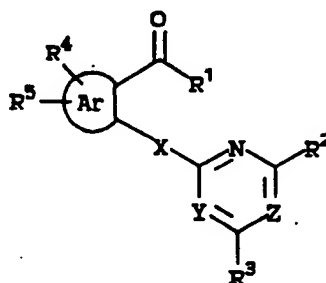
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R^1 is H, lower alkyl, lower alkoxyalkyl or lower alkylthioalkyl.

EP-A-360,163 discloses herbicidal compounds of the formula:

25

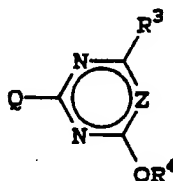
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SUMMARY OF THE INVENTION

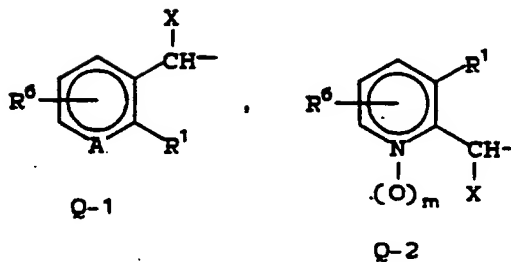
5 This invention pertains to compounds of Formula
I including all geometric and stereoisomers,
agriculturally suitable salts, agricultural
compositions containing them and their method-of-use
for the control of unwanted weeds both preemergence
10 and postemergence.



I

wherein

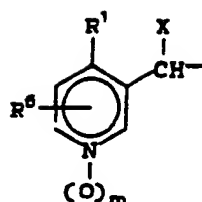
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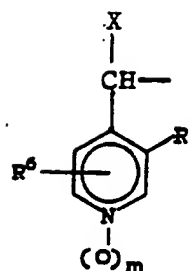
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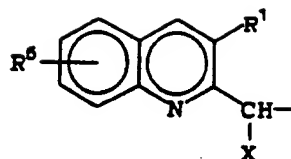
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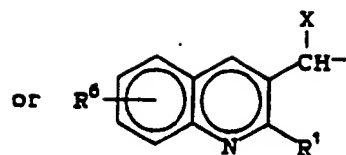
Q-4

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Q-5

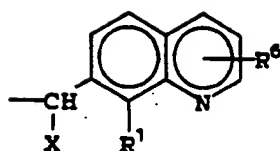


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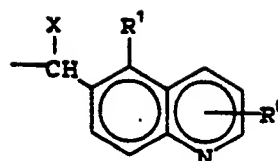
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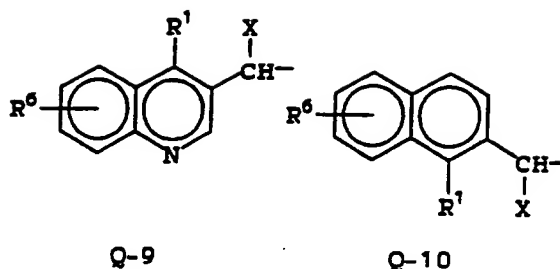
Q-7



Q-8

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- A is CR^2 , N or N-O;
 X is H, F, Cl, CH_3 , OH, $C(O)NR^{12}R^{13}$, CO_2R^{14} or CN;
 R^1 is H, CHO, $C(OCH_3)_2H$, CO_2R^5 or $C(O)SR^{11}$;
 R^2 is H, F, Cl, C_1-C_2 alkyl, C_1-C_2 -alkoxy, C_2-C_3 alkynyl, C_2-C_3 alkenyl, $S(O)_n C_1-C_2$ alkyl, NO_2 , phenoxy, C_2-C_4 alkylcarbonyl, $C(OCH_3)_2CH_3$, or $C(SCH_3)_2CH_3$;
 R^3 is C_1-C_2 alkyl, C_1-C_2 alkoxy, OCF_2H or Cl;
 R^4 is C_1-C_2 alkyl;
 R^5 is H; M; C_1-C_3 alkyl; C_2-C_3 haloalkyl; allyl; propargyl; benzyl optionally substituted with halogen, C_1-C_2 alkyl, C_1-C_2 alkoxy, CF_3 , NO_2 , SCH_3 , $S(O)CH_3$, or $S(O)_2CH_3$; C_2-C_4 alkoxyalkyl; $N=CR^7R^8$; or $CHR^9S(O)_nR^{10}$;
 R^6 is H, F, Cl, CH_3 , OCH_3 or $S(O)_nCH_3$;

35

- 5 R^7 is Cl, C_1 - C_2 alkyl or SCH_3 ;
 R^8 is C_1 - C_2 alkyl, $CO_2(C_1$ - C_2 alkyl) or
 $C(O)N(CH_3)_2$;
 R^9 is H or CH_3 ;
 R^{10} is C_1 - C_3 alkyl or phenyl optionally
substituted with halogen, CH_3 , OCH_3 or NO_2 ;
10 R^{11} is C_1 - C_2 alkyl or benzyl;
 R^{12} is H or CH_3 ;
 R^{13} is H or CH_3 ;
 R^{14} is H, C_1 - C_3 alkyl, C_2 - C_5 haloalkyl, C_3 - C_5
alkenyl, C_3 - C_5 alkynyl, C_2 - C_5 alkoxyalkyl or
benzyl optionally substituted with CH_3 ,
15 OCH_3 , SCH_3 , halogen, NO_2 or CF_3 ;
 m is 0 or 1;
 n is 0, 1 or 2;
 M is a alkali metal atom or an alkaline earth
metal atom, an ammonium group or an
20 alkylammonium group; and
 Z is CH or N.
and their agriculturally suitable salts;
provided that:
(a) when R^1 is H, then X is CO_2R^{14} ;
25 (b) when X is CO_2R^{14} , then R^1 is H; and
(c) when Z is N, then R^3 is C_1 - C_2 alkyl or
 C_1 - C_2 alkoxy.

30 In the above definitions, the term "alkyl",
used either alone or in compound words such as
"haloalkyl" includes straight chain or branched
alkyl, e.g., methyl, ethyl, n-propyl, isopropyl or
the different butyl isomers.

35 "Alkoxy", "alkenyl" and "alkynyl" analogously
also includes straight chain or branched isomers.

"Halogen", either alone or in compound words
5 such as "haloalkyl", means fluorine, chlorine,
bromine or iodine. Further, when used in compound
words such as "haloalkyl" said alkyl may be partially
or fully substituted with halogen atoms, which may be
the same or different. Examples include CF_3 , CH_2CF_3 ,
10 $\text{CH}_2\text{CH}_2\text{F}$, CF_2CF_3 and CH_2CHFCl .

The preferred compounds of the invention for
reasons including ease of synthesis and/or greater
herbicidal efficacy are:

- 15 1. Compounds of Formula I wherein
Q is Q-1 or Q-2;
2. Compounds of Preferred 1 wherein
R² is H, F, Cl, CH₃, SCH₃, OCH₃ or OCH₂CH₃;
20
3. Compounds of Preferred 2 wherein
R⁶ is H;
Z is CH;
R³ is OCH₃;
25 R⁴ is CH₃; and
X is H;
4. Compounds of Preferred 2 wherein
R⁶ is H or 3-F;
30 Z is CH;
R³ is OCH₃;
R⁴ is CH₃;
X is CO₂R¹⁴; and
R¹⁴ is C₁-C₃ alkyl, allyl, propargyl or
35 benzyl;

5. Compounds of Preferred 3 wherein
Q is Q-1;
5 R¹ is CO₂R⁵; and
R⁵ is H or M;
6. Compounds of Preferred 3 wherein
Q is Q-2;
10 R¹ is CO₂R⁵; and
R⁵ is H or M;
7. The compound of Preferred 5 which is
2-[(4,6-dimethoxy-2-pyrimidinyl)methyl]-
15 6-methyl-benzoic acid;
8. The compound of Preferred 2 which is
2-[cyano(4,6-dimethoxy-2-pyrimidinyl)methyl]-
benzoic acid;
20
9. The compound of Preferred 5 which is
2-[(4,6-dimethoxy-2-pyrimidinyl)methyl]-6-
methyl benzoic acid, sodium salt;
- 25 10. The compound of Preferred 5 which is
2-[(4,6-dimethoxy-2-pyrimidinyl)methyl]-
3-pyridine carboxylic acid;
- 30 11. The compound of Preferred 4 which is ethyl
4,6-dimethoxy-alpha-phenyl-2-
pyrimidineacetate.

The compounds of this invention are biologically
active as herbicides both post and preemergent with
35 selectivity to crops including barley, wheat, corn
and cotton.

Detailed Description of the InventionSynthesis

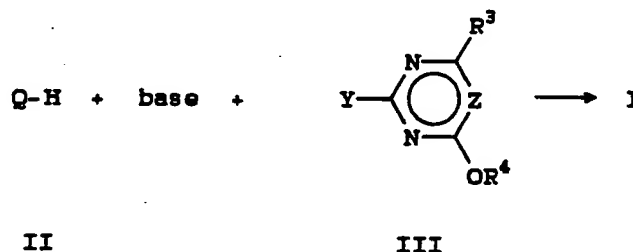
5 The compounds of Formula I can be prepared by one or more of the following methods described in Equations 1 to 4.

 The compounds of Formula I can be prepared by the reaction of an anion, formed from intermediate **II** and a base, with heterocycle **III** as shown in
10 Equation 1.

Equation 1

15

20



25

wherein:

Q-1 to Q-6, Z, R³ and R⁴ are as previously defined;

Y is Cl, Br, I, SO₂CH₃ and SO₂benzyl; and
30 within the values of Q, R¹ is C(OMe)₂H, CH₂OH, CO₂R⁵ or C(O)N(H, alkyl)(alkyl, silylalkyl); and

X is H.

35

The reaction wherein a benzylic anion is formed, is best carried out in a dry inert solvent

such as hexane, benzene, diethyl ether or tetrahydrofuran (THF). Appropriate bases include
5 hindered amine bases, such as lithium diisopropylamide (LDA) or alkyllithiums, such as methyllithium or magnesium salts, such as ethyl magnesium bromide. When R^1 contains an acidic group, a second equivalent base is required. Formation of
10 benzylic anions is further taught by Y. Thebtaranonth et al in Synthesis, 1986, 785; in Tet. Let., 1989, 30, 3861; J. Staunton et al. in J. Chem. Soc. Perkin Trans. I, 1984, 1043-1051, and F. Hauser et al. Synthesis, 1980, 72. The reaction can be carried out
15 from low temperatures -78°C (dry ice/acetone) up to the reflux point of the solvent. Generally, a lower temperature is preferred for anion formation, while the coupling of the anion II and III proceeds readily at higher temperatures.

20 When the reaction is judged complete, it is worked up in one of two manners, depending on the R^1 group. If R^1 contains an acidic group such as CO_2H , then the reaction is extracted into aqueous base, and the water layer acidified. Alternately, the
25 carboxylate can be alkylated in situ to give an alkyl or benzyl ester. The product is either collected by filtration or extracted with an organic solvent and concentrated. The residue is further purified by trituration, crystallization or chromatography in the
30 appropriate solvent. If the R^1 group contains no acidic group, i.e., an isopropylester, then the reaction is quenched with brine, the organic layer separated and concentrated followed by the appropriate purification to give the desired product.

35 The compounds of Formula I can be prepared by the reaction of a cyanomethyl derivative IV with

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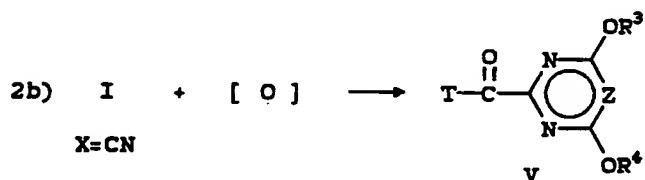
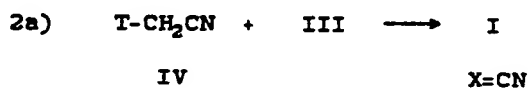
heterocycle **III** as shown in Equation 2a followed by
 oxidation, then reduction to give the alcohol, which
 5 can be converted to the halomethyl derivative (X is F
 or Cl), or further reduced to the methylene
 derivative (X is H).

Equation 2

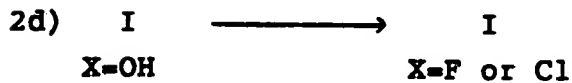
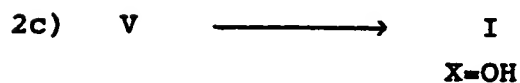
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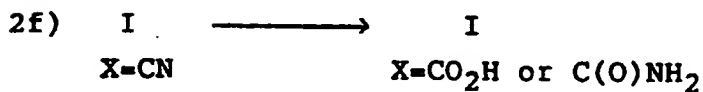
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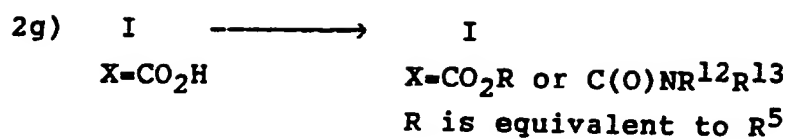


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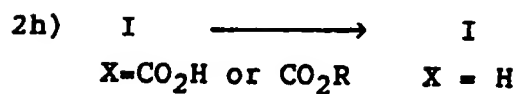


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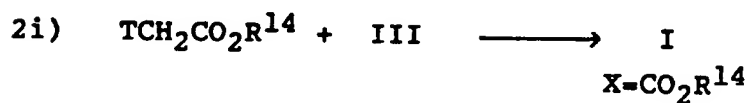
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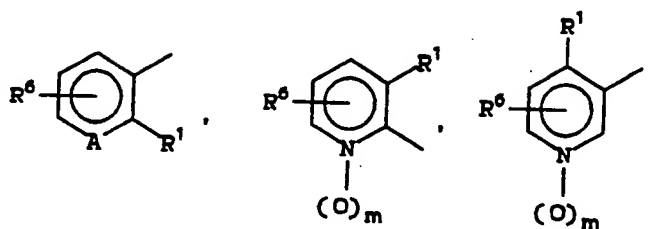


wherein:

T is

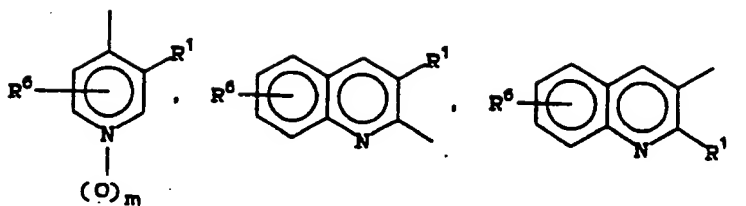
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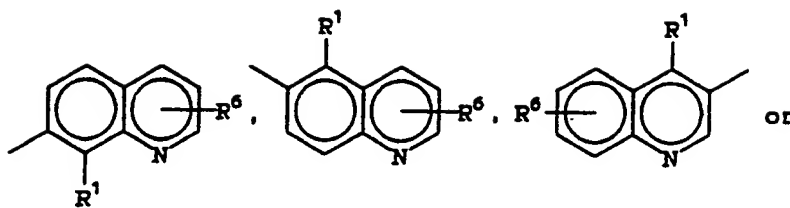
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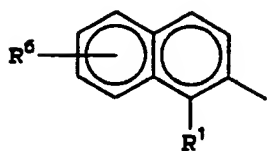
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R^1 is $C(OMe)_2H$, Br, CN, $CH_2OSiMe_2CMe_3$ or CO_2R^5 ;
 R^5 is H, M, $CHMe_2$ or CMe_3 ; and
 A and R^6 are as previously defined.

The reaction of Equation 2a wherein Y is Cl or Br can be conveniently carried out under $S_{RN}1$ conditions by preparing a mixture of one equivalent or more of potassium metal, a catalytic amount of an
 35 iron compound, i.e., ferric nitrate, in liquid

ammonia. The arylacetonitrile IV is added followed by the dropwise addition of the haloheterocycle III,
5 with concomitant irradiation from a photoreactor lamp which emits maximally at 350 nm. The reaction is irradiated from 1 to 24 hours, then the reaction is quenched with solid ammonium chloride, the ammonia is allowed to slowly evaporate. The residual material
10 is rinsed with diethylether and the filtrate is subjected to purification by recrystallization or chromatography to give the desired product. Procedures can be adapted from J. F. Wolfe et al., J. Het. Chem., 1987, 24, 1061.

15 Alternatively, the reaction of Equation 2a, wherein Y is Cl, Br, I, CH₃SO₂ or PhCH₂SO₂, is carried out under basic conditions.

The starting materials can be premixed in an inert solvent such as diethylether, THF or
20 dimethylformamide (DMF) solvent when Y is halogen, followed by addition of a strong base, such as an alkali metal hydride, i.e., NaH, or a hindered metallated base, i.e., LDA or potassium t-butoxide. Another order of addition for any Y value can be the
25 formation of the anion of acetonitrile IV in an inert solvent, followed by its addition to the heterocycle in an inert solvent. Yields are generally increased with the use of dry solvents and dry inert atmospheres, with temperatures that range from -78°C
30 to the solvent reflux point. The reaction is neutralized and the product is isolated by chromatography or crystallization. Analogous reactions are taught by R. Y. Ning et al., J. Med. Chem., 1977, 20, 1312 and F. Sauter et al., J. Chem. Res.(S), 1977, 186.

Reactions 2a and 2b can be carried out concurrently by allowing the reaction to be exposed to oxygen in the atmosphere. The oxidation of I (X is CN) to a diaryl ketone Y can be carried out by one of several procedures. S. Murahashi et al., Syn. Lett., 1989, 62, teach the oxidation of alkanenitriles with ruthenium catalyzed t-butyl hydroperoxide to give intermediate 2-(t-butyldioxy)-alkanenitriles, which are further oxidized by titanium tetrachloride.

Diarylketones Y can be reduced directly to the diarylmethanes via Equation 2e by Wolff-Kishner conditions as taught by Cram et al., J. Am. Chem. Soc., 1962, 84, 1734; Clemmensen conditions as taught by Yamamura and Hirata, J. Chem. Soc. C, 1968, 2887; or hydrogenation with a catalyst such as CuCr_2O_4 .

The diarylketones Y can also be reduced stepwise to the alcohol, I (X=OH), with lithium aluminum hydride or sodium borohydride. The alcohol can be converted to the chloride with thionyl chloride or methanesulfonyl chloride and triethylamine and to the fluoride with "DAST" (diethylaminosulfur trifluoride), see Synthesis, 1973, 787 and J. Org. Chem., 1975, 40, 574, as shown in Equations 2c and 2d.

Cyanomethanes of Formula I (X=CN) can be converted to carboxylic acids and amides by hydrolysis with either base or acid, as shown in Equation 2f.

Carboxylic acids I (X=CO₂H) can be esterified or converted to amides by methods well known to a chemist skilled in the art.

Equation 2h shows that compounds of Formula I (X=CO₂R) can be decarboxylated to the methylene

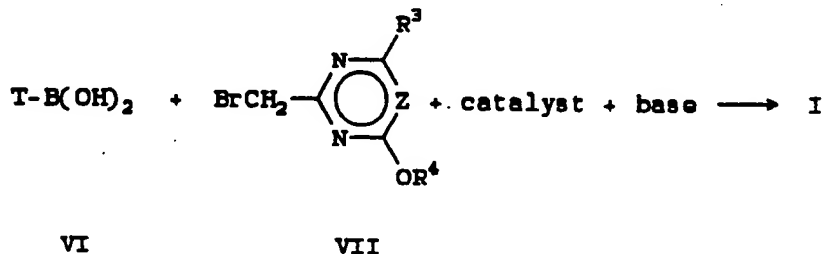
bridged compounds. Such decarboxylations are well known in the art and generally are accomplished by heating the compound with or without solvent and with or without a catalyst.

Equation 2i is carried out in a similar fashion to 2a wherein an appropriate base is reacted with the aryl acetate followed by addition of heterocycle III.

The cyanomethanes and arylacetates of Formula IV are either known in the art or prepared by simple modifications thereof. Cyanomethanes are most conveniently prepared by nucleophilic reaction of a metal cyanide, i.e., NaCN, with a benzyl halide in a suitable solvent, such as dimethylformamide, dimethylsulfoxide or THF. The benzyl halides are also well known, and easily prepared from II by methods adapted from T. Eicher, *Synthesis*, 1988, 1, 525 and Clarke et al., *J. Chem. Perkin Trans. I*, 1984, 1501.

The compounds of Formula I can be prepared by a cross-coupling reaction between an aryl boronic acid and a bromomethyl heterocycle with a catalyst as shown in Equation 3.

Equation 3



wherein:

- 5 T, Z, R³ and R⁴ are as previously defined;
 R¹ is C(OMe₂)H, CH₂OH, CO₂R⁵ or CON(H,CH₃)-
 (alkyl, alkylsilyl); and
 R⁵ is H, M, isopropyl or t-butyl.

10 The reaction is carried out by mixing the
 bromide (VII) with a transition metal catalyst, such
 as Ni(O) or Pd(O), preferably Pd(PPh₃)₄ in a suitable
 solvent, such as toluene or glyme, followed by the
 addition of boronic acid VI and the base, such as an
15 alkoxide, hydroxide or carbonate, for example NaOEt,
 NaOH or Na₂CO₃ in a suitable solvent such as water or
 ethanol. The reaction mixture is stirred from 1 to
 24 hours at room temperature to reflux. At
 completion, the reaction is filtered, and the
 filtrate is concentrated. The residue is partitioned
20 between brine and an organic solvent (EtOAc, CH₂Cl₂),
 separated, dried (Na₂SO₄, MgSO₄), and concentrated,
 whereupon the product is isolated and purified, if
 necessary, by flash chromatography, recrystallization
 or distillation. Similar procedures and
25 modifications can be found in Snieckus et al.,
 Tet. Let., 1987, 28, 5093; ibid., 1985, 26, 5997;
 Yamamoto et al., Synthesis, 1986, 564; Suzuki et al.
 Synth. Comm., 1981, 11, 513 and references
 incorporated therein.

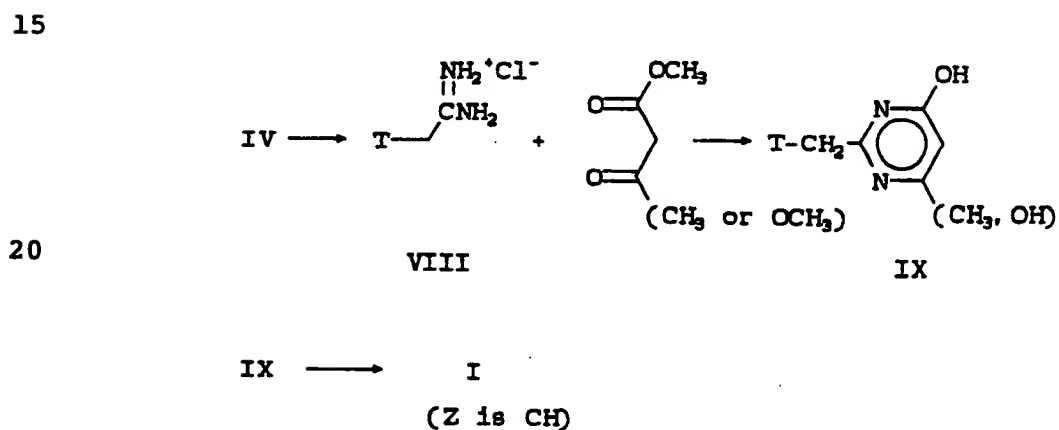
30 Formation of aryl boronic acids, VI, is well
 known in the art. They can be prepared by contacting
 an aryl organo metallic compound with B(OMe)₃
 followed by acidic workup, as in J. Org. Chem., 1984,
 49, 5237 and Tetrahedron, 1983, 39, 1955; or by
35 reaction of an arylsilane with BBr₃, followed by

addition of methanol, then dilute acid, as described in Tet. Let., 1987, 28, 5093.

5 Bromomethanes VII can be prepared by well known methods for conversion from alcohols and from methyl groups. A representative example is described in J. Het. Chem., 1989, 26, 913.

Compounds of Formula I, wherein Z is CH, can be
10 prepared by the route shown in Equation 4.

Equation 4



The reaction is carried out by reacting IV with hydrogen chloride in an alcohol to form an imidate which is converted to the amidine salt, VIII, with ammonia. The pyrimidinol IX is formed by condensation with a diketone/ester. This sequence of reactions and similar modifications can be found in H. C. van der Plas et al., Tetrahedron, 1989, 45, 6511-6518. Compounds of Formula IX can be converted

to instant compounds I by preparation of the chloropyrimidine with phosphorus oxychloride and a catalytic amount of DMF and subsequent displacement with sodium methoxide or ethoxide.

Heterocycles of Formula III are generally known in the art or can be prepared by simple modifications thereof. For example, preparation of chlorotriazines is described in J. Am. Chem. Soc., 1951, 73, 2989, while chloropyrimidines are described in J. Chem. Soc. (C), 1966, 2031. General references, particularly to aminoheterocycles, can be found in "The Chemistry of Heterocyclic Compounds", a series published by Interscience Publishers, Inc., New York and London. The alkylsulfonyl and benzylsulfonyl heterocycles can also be prepared by the general reference above and more specifically by alkylation of thiols, as described in J. Med. Chem., 1984, 27, 1621-1629, followed by oxidation, most commonly by m-chloroperoxybenzoic acid.

The arylmethanes of Formula II are known in the art or easily prepared by methods therein.

The R¹ groups of Equations 1 to 4 can be converted into the claimed R¹ groups by techniques well known to one skilled in the art. For example, benzyl alcohols can be oxidized to aldehydes with many reagents, including pyridinium chlorochromate (PCC) and/or further oxidized to the carboxylate with potassium permanganate (KMnO₄). A sample procedure involving a phase transfer reagent is found in Can. J. Chem., 1989, 67, 1381.

Additionally, conversion to and from various preferred R¹ groups are well known to one skilled in the art. Many are described in T. Greene, Protective

Groups in Organic Synthesis, 1981, John Wiley and Sons, New York.

5 Carboxylic acid salts of Formula I (R^1 is CO_2M) can be prepared by reacting the carboxylic acid of Formula I (R^1 is CO_2H) with a base in the presence or absence of a solvent within a temperature range from room temperature to the boiling point of the solvent
10 from 5 minutes to 24 hours. The solvent may be a hydrocarbon such as benzene or toluene, a halogenated hydrocarbon such as methylene chloride or chloroform, an alcohol such as methanol, ethanol or isopropanol, and other solvents, such as ethyl ether, THF,
15 acetone, methyl ethyl ketone, ethyl acetate or acetonitrile. The base may be an alkali metal such as sodium metal or potassium metal, an alkali metal or alkaline earth metal hydride such as sodium hydride, potassium hydride or calcium hydride, a
20 carbonate such as sodium carbonate, potassium carbonate or calcium carbonate, or a metal hydroxide such as sodium hydroxide or potassium hydroxide. The organic base may be ammonia, an alkylamine (primary amine), a dialkylamine (secondary amine) or a
25 trialkylamine (tertiary amine).

Example 1

2-[(4,6-Dimethoxy-2-pyrimidinyl)methyl]-6-methylbenzoic acid

30 To a cooled ($15^\circ C$) suspension of sodium hydride (8.79 g, 0.183 mol), prewashed with dry hexanes, in 300 mL anhydrous THF under an N_2 atmosphere was added 2,6-dimethylbenzoic acid (24.5 g, 0.166 mol),
portionwise. Additional THF (300 mL) was added to
35 facilitate stirring in the resultant slurry. Then 142 mL of 1.4 M methyllithium (0.199 mol) was added

dropwise at room temperature. One-twelfth of the resultant red solution (50 mL, 0.0138 mol), was added
5 to 1.50 g of 4,6-dimethoxy-2-(methylsulfonyl)-pyrimidine (0.068 mol) under N₂ at room temperature. After 4 hours, the reaction was diluted with 100 mL 1N HCl and 100 mL brine. The layers were separated; the aqueous layer was extracted with 100 mL ethyl
10 acetate. The combined organic layers were dried (MgSO₄), filtered and concentrated to give 2.5 g of a yellow oil. Addition of Et₂O gave a small amount of white precipitate, which was removed by filtration. The filtrate was subjected to flash column
15 chromatography (40 mm x 6" of SiO₂), eluted with 25% ethyl acetate/hexanes (v/v), initially, then 50:49:1 ethyl acetate in hexane/methanol. The fractions containing product were collected and concentrated under reduced pressure. The resultant oil
20 crystallized on standing to give 0.41 g solid, m.p. 122-124°C.
IR (nujol) = 1710 cm⁻¹.
Mass Spec. m/e = 289 (100, M+1).
PMR (200 MHz, CDCl₃) δ 2.49 (s, CH₃, 3H), 3.5-3.9
25 (bs, OH, 1H), 3.93 (s, OCH₃, 6H), 4.15 (s, CH₂, 2H), 5.91 (s, pyrm-H, 1H), 7.0-7.3 (m, ArH, 3H).

Example 2

30 2-[Cyano(4,6-dimethoxy-2-pyrimidinyl)methyl]-benzoic acid

a) To a suspension of 60% NaH (0.38 g, prewashed with hexanes) in 50 mL dry THF was simultaneously added methyl 2-cyanomethylbenzoate (1.6 g) and
35 4,6-dimethoxy-2-methylsulfonylpyrimidine (1.99 g) in dry THF. After addition, the reaction was refluxed

for 2 days, then 1.0 g of potassium t-butoxide was added. After 1 day, the reaction was quenched with
5 25 mL of brine and neutralized with 1 N HCl. The organic layer was concentrated under reduced pressure to give 2.87 g of an oil. The oil was subjected to flash column chromatography (SiO₂), eluted with EtOAc/hexane (1:9) to give 0.75 g of solid, m.p.
10 79-81°C.

PMR (200 MHz, CDCl₃) δ 3.86 (s, OCH₃, 6H), 3.90 (s, OCH₃, 3H), 5.89 (s, pyrm-H, 1H), 6.74 (s, CHCN, 1H), 7.35-8.05 (m, ArH, 4H).

15 b) The product of 2a (0.43 g) was dissolved in a solution of 1.6 mL of 12% aqueous NaOH and 12 mL of ethanol. After 12 hours, the reaction mixture was diluted with 15 mL of .4 M NaOH and washed with Et₂O. The aqueous layer was acidified, then
20 extracted with EtOAc. The organic layer was concentrated under reduced pressure and the residue was triturated with butyl chloride to give 0.15 g solid, m.p. 214-216°C.

25 NMR (90 MHz, CDCl₃) δ 3.9 (s, OCH₃), 6.0 (s, pyrm-H, 1H), 6.9 (s, CHCN, 1H), 7.4-8.3 (m, ArH, 4H), 11.0 (bs, CO₂H, 1H).

Example 3

2-[(4,6-Dimethoxy-2-pyrimidinyl)methyl]-3-pyridinecarboxylic acid

30

To a cooled (-78°C) suspension of 2-methylnicotinic acid (1.4 g, 10.2 mmol) in 100 mL dry THF was added 11.25 mL 1.95 M LDA dropwise. The reaction turned purple and warmed to -65°C. Allowed
35 to recool to -78°C, then added 2-chloro-4,6-dimethoxy-pyrimidine (1.75 g, 10 mmol). The reaction was

allowed to warm to room temperature over 2 days. The solvent was removed under reduced pressure. The residue was partitioned between Et₂O and water, which was basified to pH 8-9. The aqueous layer was acidified, then extracted with EtOAc, dried (MgSO₄), and concentrated under reduced pressure to give 1.33 g of a brown oil. This oil was subjected to flash column chromatography on SiO₂, eluted with 97:2:1 (EtOAc:MeOH:HOAc), to give after trituration with BuCl/hexanes a solid, 0.29 g, m.p. 182-186°C. Mass Spec.: m/e 276 (100, MH⁺). PMR (acetone-d₆, 200 MHz) δ 3.8 (s, OMe, 6H), 4.8 (s, CH₂, 2H), 5.9 (s, pyr-H, 1H), 7.4 (m) + 8.3 (m) + 8.7 (m)[pyrH, 3x 1H].

Example 4

4,6-Dimethoxy-α-phenyl-2-pyrimidineacetic acid, ethyl ester.

To a cooled (-78°C) solution of ethyl phenylacetate (0.79 ml, 5mmol) in 30 mL anhydrous THF under an N₂ atmosphere was added 2.86 mL of 1.9M LDA dropwise, followed by 1.0 g of 4,6-dimethoxy-2-methylsulfonylpyrimidine. The reaction mixture was allowed to warm to room temperature over 6 h then quenched with 20 mL brine and 5 mL of 1 N HCl. The layers were separated and the aqueous layer was extracted with ethyl acetate. The combined organic layers were washed once with brine, dried (MgSO₄), filtered and concentrated under reduced pressure to give 1.6 g of a brown oil. The oil was subjected to flash column chromatography (SiO₂), eluted with Et₂O/hexanes (1:9) to give 0.63g of the product as an oil. PMR (200 MHz, CDCl₃) δ 1.24 (t, CH₃, 3H), 3.89

25

(S, OCH₃, 6H), 5.08 (S, CH, 1H), 5.89 (s, pyrnmH, 1H),
7.2-7.6 (m, ArH, 5H).

5

Using the procedures of Equations 1 to 4 and
Examples 1 to 4, the compounds of Tables 1 to 7 can
be prepared by one skilled in the art.

10

15

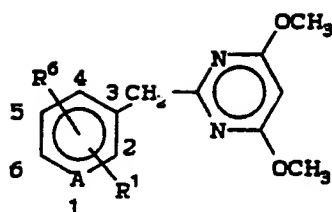
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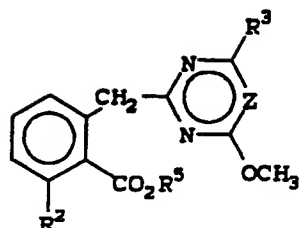
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TABLE 1



A	R ¹	R ⁶	A	R ¹	R ⁶
N	2-CHO	H	CH	2-CHO	H
N	2-CHO	4-Cl	CCH ₃	2-CHO	H
N	2-CO ₂ H	H	CCl	2-CHO	H
N	2-CO ₂ H	4-F	COCH ₃	2-CHO	H
N	2-CO ₂ H	5-OCH ₃	CH	2-CHO	4-F
N	2-CO ₂ H	6-SCH ₃	CH	2-CO ₂ H	4-F
N	2-CO ₂ CH ₃	H	CH	2-CO ₂ H	4-OCH ₃
N	2-CO ₂ CH ₂ CH=CH ₂	H	CH	2-CO ₂ H	4-OCH ₂ CH ₃
N	2-CO ₂ CH ₂ C≡CH	H	CC(OMe) ₂ CH ₃	2-CO ₂ H	H
N	2-CO ₂ CH ₂ C ₆ H ₅	H	COC ₆ H ₅	2-CO ₂ H	H
N	2-CO ₂ CH ₂ -3-Cl-C ₆ H ₄	H	CH	2-CO ₂ CH ₃	4-Cl
N	2-CO ₂ Na	H	CH	2-CO ₂ CH ₃	4-SCH ₃
N	2-CO ₂ H·NH ₂ CHMe ₂	H	CH	2-CO ₂ CH ₃	6-SO ₂ CH ₃
N-O	2-CO ₂ H	H	CH	2-CO ₂ CH ₃	5-Cl
N	4-CHO	H			
N	4-CO ₂ H	H			
N	4-CO ₂ Na	H			
N	4-CO ₂ H	5-Cl			

TABLE 2



R ⁵	R ²	R ³	Z	R ⁵	R ²	R ³	Z
H	H	CH ₃	CH	H	OCH ₂ CH ₃	OCH ₃	CH
H	H	Cl	CH	H	C≡CH	CH ₃	CH
H	H	OCH ₃	CH	H	C≡CH	Cl	CH
H	F	CH ₃	CH	H	C≡CH	OCH ₃	CH
H	F	Cl	CH	H	SCH ₃	CH ₃	CH
H	F	OCH ₃	CH	H	SCH ₃	Cl	CH
H	Cl	CH ₃	CH	H	SCH ₃	OCH ₃	CH
H	Cl	Cl	CH	H	H	CH ₃	N
H	Cl	OCH ₃	CH	H	H	CH ₂ CH ₃	N
H	CH ₃	CH ₃	CH	H	H	OCH ₃	N
H	CH ₃	Cl	CH	H	F	CH ₃	N
H	CH ₃	OCH ₃	CH	H	F	CH ₂ CH ₃	N
H	CH ₂ CH ₃	CH ₃	CH	H	F	OCH ₃	N
H	CH ₂ CH ₃	Cl	CH	H	Cl	CH ₃	N
H	CH ₂ CH ₃	OCH ₃	CH	H	Cl	CH ₂ CH ₃	N
H	OCH ₃	CH ₃	CH	H	Cl	OCH ₃	N
H	OCH ₃	Cl	CH	H	CH ₃	CH ₃	N
H	OCH ₃	OCH ₃	CH	H	CH ₃	CH ₂ CH ₃	N
H	OCH ₂ CH ₃	CH ₃	CH	H	CH ₃	OCH ₃	N
H	OCH ₂ CH ₃	Cl	CH	H	CH ₂ CH ₃	CH ₃	N

R ⁵	R ²	R ³	Z	R ⁵	R ²	R ³	Z
H	CH ₂ CH ₃	CH ₂ CH ₃	N	H	SOCH ₃	CH ₂ CH ₃	N
H	CH ₂ CH ₃	OCH ₃	N	H	SOCH ₃	OCH ₃	N
H	OCH ₃	CH ₃	N	H	SO ₂ CH ₃	CH ₃	N
H	OCH ₃	CH ₂ CH ₃	N	H	SO ₂ CH ₃	CH ₂ CH ₃	N
H	OCH ₃	OCH ₃	N	H	SO ₂ CH ₃	OCH ₃	N
H	OCH ₂ CH ₃	CH ₃	N	H	SO ₂ CH ₂ CH ₃	CH ₃	N
H	OCH ₂ CH ₃	CH ₂ CH ₃	N	H	SO ₂ CH ₂ CH ₃	CH ₂ CH ₃	N
H	OCH ₂ CH ₃	OCH ₃	N	H	SO ₂ CH ₂ CH ₃	OCH ₃	N
H	C≡CH	CH ₃	N	H	OC ₆ H ₅	CH ₃	N
H	C≡CH	CH ₂ CH ₃	N	H	OC ₆ H ₅	CH ₂ CH ₃	N
H	C≡CH	OCH ₃	N	H	OC ₆ H ₅	OCH ₃	N
H	SCH ₃	CH ₃	N	CH ₃	H	CH ₃	CH
H	SCH ₃	CH ₂ CH ₃	N	CH ₃	H	Cl	CH
H	SCH ₃	OCH ₃	N	CH ₃	H	OCH ₃	CH
H	SCH ₂ CH ₃	CH ₃	CH	CH ₃	F	CH ₃	CH
H	SCH ₂ CH ₃	Cl	CH	CH ₃	F	Cl	CH
H	SCH ₂ CH ₃	OCH ₃	CH	CH ₃	F	OCH ₃	CH
H	SOCH ₃	CH ₃	CH	CH ₃	Cl	CH ₃	CH
H	SOCH ₃	Cl	CH	CH ₃	Cl	Cl	CH
H	SOCH ₃	OCH ₃	CH	CH ₃	Cl	OCH ₃	CH
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H	SO ₂ CH ₂ CH ₃	CH ₃	CH	CH ₃	CH ₂ CH ₃	CH ₃	CH
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H	OC ₆ H ₅	CH ₃	CH	CH ₃	OCH ₃	CH ₃	CH
H	OC ₆ H ₅	Cl	CH	CH ₃	OCH ₃	Cl	CH
H	OC ₆ H ₅	OCH ₃	CH	CH ₃	OCH ₃	OCH ₃	CH
H	SCH ₂ CH ₃	CH ₃	N	CH ₃	OCH ₂ CH ₃	CH ₃	CH
H	SCH ₂ CH ₃	CH ₂ CH ₃	N	CH ₃	OCH ₂ CH ₃	Cl	CH
H	SCH ₂ CH ₃	OCH ₃	N	CH ₃	OCH ₂ CH ₃	OCH ₃	CH
H	SOCH ₃	CH ₃	N	CH ₃	C≡CH	CH ₃	CH

R ⁵	R ²	R ³	Z	R ⁵	R ²	R ³	Z
CH ₃	C≡CH	Cl	CH	CH ₃	SCH ₂ CH ₃	CH ₃	CH
CH ₃	C≡CH	OCH ₃	CH	CH ₃	SCH ₂ CH ₃	Cl	CH
CH ₃	SCH ₃	CH ₃	CH	CH ₃	SCH ₂ CH ₃	OCH ₃	CH
CH ₃	SCH ₃	Cl	CH	CH ₃	SOCH ₃	CH ₃	CH
CH ₃	SCH ₃	OCH ₃	CH	CH ₃	SOCH ₃	Cl	CH
H	CH ₃	CH ₃	N	CH ₃	SOCH ₃	OCH ₃	CH
H	CH ₃	CH ₂ CH ₃	N	CH ₃	SO ₂ CH ₃	CH ₃	CH
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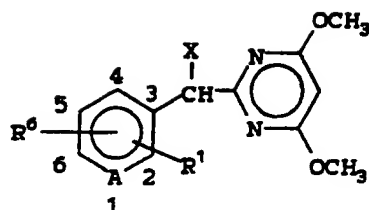
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Na	F	Cl	CH	Na	CH ₃	CH ₃	N
Na	F	OCH ₃	CH	Na	CH ₃	CH ₂ CH ₃	N
Na	Cl	CH ₃	CH	Na	CH ₃	OCH ₃	N
Na	Cl	Cl	CH	Na	CH ₂ CH ₃	CH ₃	N
Na	Cl	OCH ₃	CH	Na	CH ₂ CH ₃	CH ₂ CH ₃	N
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Na	CH ₂ CH ₃	CH ₃	CH	Na	OCH ₃	OCH ₃	N
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Na	C≡CH	CH ₃	CH	Na	SCH ₃	OCH ₃	N
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Na	C≡CH	OCH ₃	CH	Na	SCH ₂ CH ₃	Cl	CH
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Na	F	OCH ₃	N	Na	SO ₂ CH ₂ CH ₃	Cl	CH
Na	Cl	CH ₃	N	Na	SO ₂ CH ₂ CH ₃	OCH ₃	CH

R ⁵	R ²	R ³	Z	R ⁵	R ²	R ³	Z
Na	OC ₆ H ₅	CH ₃	CH	H•NH ₂ CHMe ₂	CH ₂ CH ₃	OCH ₃	CH
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Na	OC ₆ H ₅	OCH ₃	CH	H•NH ₂ CHMe ₂	OCH ₃	Cl	CH
Na	SCH ₂ CH ₃	CH ₃	N	H•NH ₂ CHMe ₂	OCH ₃	OCH ₃	CH
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Na	SOCH ₃	CH ₃	N	H•NH ₂ CHMe ₂	OCH ₂ CH ₃	OCH ₃	CH
Na	SOCH ₃	CH ₂ CH ₃	N	H•NH ₂ CHMe ₂	C≡CH	CH ₃	CH
Na	SOCH ₃	OCH ₃	N	H•NH ₂ CHMe ₂	C≡CH	Cl	CH
Na	SO ₂ CH ₃	CH ₃	N	H•NH ₂ CHMe ₂	C≡CH	OCH ₃	CH
Na	SO ₂ CH ₃	CH ₂ CH ₃	N	H•NH ₂ CHMe ₂	SCH ₃	CH ₃	CH
Na	SO ₂ CH ₃	OCH ₃	N	H•NH ₂ CHMe ₂	SCH ₃	Cl	CH
Na	SO ₂ CH ₂ CH ₃	CH ₃	N	H•NH ₂ CHMe ₂	SCH ₃	OCH ₃	N
Na	SO ₂ CH ₂ CH ₃	CH ₂ CH ₃	N	H•NH ₂ CHMe ₂	H	CH ₃	N
Na	SO ₂ CH ₂ CH ₃	OCH ₃	N	H•NH ₂ CHMe ₂	H	CH ₂ CH ₃	N
Na	OC ₆ H ₅	CH ₃	N	H•NH ₂ CHMe ₂	H	OCH ₃	N
Na	OC ₆ H ₅	CH ₂ CH ₃	N	H•NH ₂ CHMe ₂	F	CH ₃	N
Na	OC ₆ H ₅	OCH ₃	N	H•NH ₂ CHMe ₂	F	CH ₂ CH ₃	N
H•NH ₂ CHMe ₂	H	CH ₃	CH	H•NH ₂ CHMe ₂	F	OCH ₃	N
H•NH ₂ CHMe ₂	H	Cl	CH	H•NH ₂ CHMe ₂	Cl	CH ₃	N
H•NH ₂ CHMe ₂	H	OCH ₃	CH	H•NH ₂ CHMe ₂	Cl	CH ₂ CH ₃	N
H•NH ₂ CHMe ₂	F	CH ₃	CH	H•NH ₂ CHMe ₂	Cl	OCH ₃	N
H•NH ₂ CHMe ₂	F	Cl	CH	H•NH ₂ CHMe ₂	CH ₃	CH ₃	N
H•NH ₂ CHMe ₂	F	OCH ₃	CH	H•NH ₂ CHMe ₂	CH ₃	CH ₂ CH ₃	N
H•NH ₂ CHMe ₂	Cl	CH ₃	CH	H•NH ₂ CHMe ₂	CH ₃	OCH ₃	N
H•NH ₂ CHMe ₂	Cl	Cl	CH	H•NH ₂ CHMe ₂	CH ₂ CH ₃	CH ₃	N
H•NH ₂ CHMe ₂	Cl	OCH ₃	CH	H•NH ₂ CHMe ₂	CH ₂ CH ₃	CH ₂ CH ₃	N
H•NH ₂ CHMe ₂	CH ₃	CH ₃	CH	H•NH ₂ CHMe ₂	CH ₂ CH ₃	OCH ₃	N
H•NH ₂ CHMe ₂	CH ₃	Cl	CH	H•NH ₂ CHMe ₂	OCH ₃	CH ₃	N
H•NH ₂ CHMe ₂	CH ₃	OCH ₃	CH	H•NH ₂ CHMe ₂	OCH ₃	CH ₂ CH ₃	N
H•NH ₂ CHMe ₂	CH ₂ CH ₃	CH ₃	CH	H•NH ₂ CHMe ₂	OCH ₃	OCH ₃	N
H•NH ₂ CHMe ₂	CH ₂ CH ₃	Cl	CH	H•NH ₂ CHMe ₂	OCH ₂ CH ₃	CH ₃	N

R ⁵	R ²	R ³	Z	R ⁵	R ²	R ³	Z
H•NH ₂ CHMe ₂	OCH ₂ CH ₃	CH ₂ CH ₃	N	H•NH ₂ CHMe ₂	SO ₂ CH ₃	OCH ₃	N
H•NH ₂ CHMe ₂	OCH ₂ CH ₃	OCH ₃	N	H•NH ₂ CHMe ₂	SO ₂ CH ₂ CH ₃	CH ₃	N
H•NH ₂ CHMe ₂	C≡CH	CH ₃	N	H•NH ₂ CHMe ₂	SO ₂ CH ₂ CH ₃	CH ₂ CH ₃	N
H•NH ₂ CHMe ₂	C≡CH	CH ₂ CH ₃	N	H•NH ₂ CHMe ₂	SO ₂ CH ₂ CH ₃	OCH ₃	N
H•NH ₂ CHMe ₂	C≡CH	OCH ₃	N	H•NH ₂ CHMe ₂	OC ₆ H ₅	CH ₃	N
H•NH ₂ CHMe ₂	SCH ₃	CH ₃	N	H•NH ₂ CHMe ₂	OC ₆ H ₅	CH ₂ CH ₃	N
H•NH ₂ CHMe ₂	SCH ₃	CH ₂ CH ₃	N	H•NH ₂ CHMe ₂	OC ₆ H ₅	OCH ₃	N
H•NH ₂ CHMe ₂	SCH ₃	OCH ₃	N	CH ₂ CF ₃	H	CH ₃	CH
H•NH ₂ CHMe ₂	SCH ₂ CH ₃	CH ₃	CH	CH ₂ CF ₃	H	OCH ₃	CH
H•NH ₂ CHMe ₂	SCH ₂ CH ₃	Cl	CH	CH ₂ CF ₃	Cl	OCH ₃	CH
H•NH ₂ CHMe ₂	SCH ₂ CH ₃	OCH ₃	CH	CH ₂ CH ₂ Cl	F	CH ₃	CH
H•NH ₂ CHMe ₂	SOCH ₃	CH ₃	CH	CH ₂ CH ₂ Cl	F	OCH ₃	CH
H•NH ₂ CHMe ₂	SOCH ₃	Cl	CH	CH ₂ CH ₂ Cl	H	OCH ₃	CH
H•NH ₂ CHMe ₂	SOCH ₃	OCH ₃	CH	CH ₂ CH=CH ₂	Cl	CH ₃	CH
H•NH ₂ CHMe ₂	SO ₂ CH ₃	CH ₃	CH	CH ₂ CH=CH ₂	Cl	OCH ₃	CH
H•NH ₂ CHMe ₂	SO ₂ CH ₃	Cl	CH	CH ₂ CH=CH ₂	H	OCH ₃	CH
H•NH ₂ CHMe ₂	SO ₂ CH ₃	OCH ₃	CH	CH ₂ C≡CH	CH ₃	CH ₃	CH
H•NH ₂ CHMe ₂	SO ₂ CH ₂ CH ₃	CH ₃	CH	CH ₂ C≡CH	CH ₃	OCH ₃	CH
H•NH ₂ CHMe ₂	SO ₂ CH ₂ CH ₃	Cl	CH	CH ₂ C≡CH	H	OCH ₃	CH
H•NH ₂ CHMe ₂	SO ₂ CH ₂ CH ₃	OCH ₃	CH	CH ₂ -4-Cl-C ₆ H ₄	CH ₂ CH ₃	CH ₃	CH
H•NH ₂ CHMe ₂	OC ₆ H ₅	CH ₃	CH	CH ₂ -4-Cl-C ₆ H ₄	CH ₂ CH ₃	OCH ₃	CH
H•NH ₂ CHMe ₂	OC ₆ H ₅	Cl	CH	CH ₂ -4-Cl-C ₆ H ₄	H	OCH ₃	CH
H•NH ₂ CHMe ₂	OC ₆ H ₅	OCH ₃	CH	CH ₂ -2-F-C ₆ H ₄	OCH ₃	CH ₃	CH
H•NH ₂ CHMe ₂	SCH ₂ CH ₃	CH ₃	N	CH ₂ -2-F-C ₆ H ₄	OCH ₃	OCH ₃	CH
H•NH ₂ CHMe ₂	SCH ₂ CH ₃	CH ₂ CH ₃	N	CH ₂ -2-F-C ₆ H ₄	H	OCH ₃	CH
H•NH ₂ CHMe ₂	SCH ₂ CH ₃	OCH ₃	N	CH ₂ CH ₂ OCH ₃	OCH ₂ CH ₃	CH ₃	CH
H•NH ₂ CHMe ₂	SOCH ₃	CH ₃	N	CH ₂ CH ₂ OCH ₃	OCH ₂ CH ₃	OCH ₃	CH
H•NH ₂ CHMe ₂	SOCH ₃	CH ₂ CH ₃	N	CH ₂ CH ₂ OCH ₃	H	OCH ₃	CH
H•NH ₂ CHMe ₂	SOCH ₃	OCH ₃	N	Li	C≡CH	CH ₃	CH
H•NH ₂ CHMe ₂	SO ₂ CH ₃	CH ₃	N	Li	C≡CH	OCH ₃	CH
H•NH ₂ CHMe ₂	SO ₂ CH ₃	CH ₂ CH ₃	N	Li	H	OCH ₃	CH

R^5	R^2	R^3	Z	R^5	R^2	R^3	Z
K	SCH ₃	CH ₃	CH	C ₆ H ₅	SO ₂ CH ₃	CH ₃	CH
K	SCH ₃	OCH ₃	CH	C ₆ H ₅	SO ₂ CH ₃	Cl	CH
K	H	OCH ₃	CH	C ₆ H ₅	H	OCH ₃	CH
CH ₂ CF ₃	H	CH ₃	N	H•NHET ₂	SCH ₂ CH ₃	CH ₃	CH
CH ₂ CF ₃	H	OCH ₃	N	H•NHET ₂	SCH ₂ CH ₃	OCH ₃	CH
CH ₂ CF ₃	F	OCH ₃	N	H•NHET ₂	SCH ₂ CH ₃	OCH ₃	CH
CH ₂ CH ₂ Cl	F	CH ₃	N	C ₆ H ₅	SO ₂ CH ₃	CH ₃	CH
CH ₂ CH ₂ Cl	F	OCH ₃	N	C ₆ H ₅	SO ₂ CH ₃	CH ₂ CH ₃	CH
CH ₂ CH ₂ Cl	H	OCH ₃	N	C ₆ H ₅	SO ₂ CH ₃	OCH ₃	CH
CH ₂ CH=CH ₂	Cl	CH ₃	N				
CH ₂ CH=CH ₂	Cl	OCH ₃	N				
CH ₂ CH=CH ₂	Cl	OCH ₃	N				
CH ₂ C≡CH	CH ₃	CH ₃	N				
CH ₂ C≡CH	CH ₃	OCH ₃	N				
CH ₂ C≡CH	CH ₃	OCH ₃	N				
CH ₂ -4-Cl-C ₆ H ₄	CH ₂ CH ₃	CH ₃	N				
CH ₂ -4-Cl-C ₆ H ₄	CH ₂ CH ₃	OCH ₃	N				
CH ₂ -4-Cl-C ₆ H ₄	CH ₂ CH ₃	OCH ₃	N				
CH ₂ -2-F-C ₆ H ₄	OCH ₃	CH ₃	N				
CH ₂ -2-F-C ₆ H ₄	OCH ₃	OCH ₃	N				
CH ₂ -2-F-C ₆ H ₄	OCH ₃	OCH ₃	N				
CH ₂ CH ₂ OCH ₃	OCH ₂ CH ₃	CH ₃	N				
CH ₂ CH ₂ OCH ₃	OCH ₂ CH ₃	OCH ₃	N				
CH ₂ CH ₂ OCH ₃	OCH ₂ CH ₃	OCH ₃	N				
Li	C≡CH	CH ₃	N				
Li	C≡CH	OCH ₃	N				
Li	C≡CH	OCH ₃	N				
K	SCH ₃	CH ₃	N				
K	SCH ₃	OCH ₃	N				
K	SCH ₃	OCH ₃	N				
H•NHET ₂	SCH ₂ CH ₃	CH ₃	CH				
H•NHET ₂	SCH ₂ CH ₃	OCH ₃	CH				
H•NHET ₂	H	OCH ₃	CH				

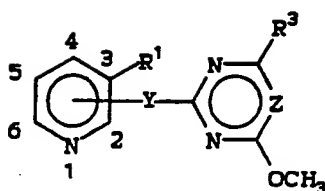
TABLE 3



A	R ⁶	X	R ¹	A	R ⁶	X	R ¹
CH	H	F	2-CO ₂ H	COCH ₃	H	F	2-CO ₂ H
CH	H	F	2-CO ₂ CH ₃	COCH ₃	H	F	2-CO ₂ CH ₃
CH	H	F	2-CO ₂ CH ₂ Ph	COCH ₃	H	F	2-CO ₂ CH ₂ Ph
CH	H	Cl	2-CO ₂ H	COCH ₃	H	Cl	2-CO ₂ H
CH	H	Cl	2-CO ₂ CH ₃	COCH ₃	H	Cl	2-CO ₂ CH ₃
CH	H	Cl	2-CO ₂ CH ₂ Ph	COCH ₃	H	Cl	2-CO ₂ CH ₂ Ph
CH	H	CH ₃	2-CO ₂ H	COCH ₃	H	CH ₃	2-CO ₂ H
CH	H	CH ₃	2-CO ₂ CH ₃	COCH ₃	H	CH ₃	2-CO ₂ CH ₃
CH	H	CH ₃	2-CO ₂ CH ₂ Ph	COCH ₃	H	CH ₃	2-CO ₂ CH ₂ Ph
CCH ₃	H	F	2-CO ₂ H	CCl	H	F	2-CO ₂ H
CCH ₃	H	F	2-CO ₂ CH ₃	CCl	H	F	2-CO ₂ CH ₃
CCH ₃	H	F	2-CO ₂ CH ₂ Ph	CCl	H	F	2-CO ₂ CH ₂ Ph
CCH ₃	H	Cl	2-CO ₂ H	CCl	H	Cl	2-CO ₂ H
CCH ₃	H	Cl	2-CO ₂ CH ₃	CCl	H	Cl	2-CO ₂ CH ₃
CCH ₃	H	Cl	2-CO ₂ CH ₂ Ph	CCl	H	Cl	2-CO ₂ CH ₂ Ph
CCH ₃	H	CH ₃	2-CO ₂ H	CCl	H	CH ₃	2-CO ₂ H
CCH ₃	H	CH ₃	2-CO ₂ CH ₃	CCl	H	CH ₃	2-CO ₂ CH ₃
CCH ₃	H	CH ₃	2-CO ₂ CH ₂ Ph	CCl	H	CH ₃	2-CO ₂ CH ₂ Ph

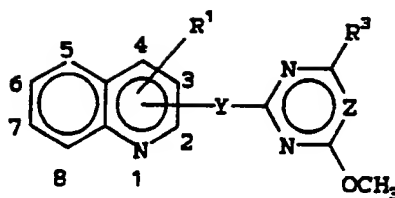
A	R ⁶	X	R ¹	A	R ⁶	X	R ¹
N	H	F	2-CO ₂ H	N	H	F	4-CO ₂ H
N	H	F	2-CO ₂ CH ₃	N	H	F	4-CO ₂ CH ₃
N	H	F	2-CO ₂ CH ₂ Ph	N	H	F	4-CO ₂ CH ₂ Ph
N	H	Cl	2-CO ₂ H	N	H	Cl	4-CO ₂ H
N	H	Cl	2-CO ₂ CH ₃	N	H	Cl	4-CO ₂ CH ₃
N	H	Cl	2-CO ₂ CH ₂ Ph	N	H	Cl	4-CO ₂ CH ₂ Ph
N	H	CH ₃	2-CO ₂ H	N	H	CH ₃	4-CO ₂ H
N	H	CH ₃	2-CO ₂ CH ₃	N	H	CH ₃	4-CO ₂ CH ₃
N	H	CH ₃	2-CO ₂ CH ₂ Ph	N	H	CH ₃	4-CO ₂ CH ₂ Ph
N	4-F	F	2-CO ₂ H	N	2-F	F	4-CO ₂ H
N	4-F	F	2-CO ₂ CH ₃	N	2-F	F	4-CO ₂ CH ₃
N	4-F	F	2-CO ₂ CH ₂ Ph	N	2-F	F	4-CO ₂ CH ₂ Ph
N	5-OCH ₃	CH ₃	2-CO ₂ H	N	5-OCH ₃	CH ₃	4-CO ₂ H
N	5-OCH ₃	CH ₃	2-CO ₂ CH ₃	N	5-OCH ₃	CH ₃	4-CO ₂ CH ₃
N	5-OCH ₃	CH ₃	2-CO ₂ CH ₂ Ph	N	5-OCH ₃	CH ₃	4-CO ₂ CH ₂ Ph
N	6-SCH ₃	Cl	2-CO ₂ H	N	6-SCH ₃	Cl	4-CO ₂ H
N	6-SCH ₃	Cl	2-CO ₂ CH ₃	N	6-SCH ₃	Cl	4-CO ₂ CH ₃
N	6-SCH ₃	Cl	2-CO ₂ CH ₂ Ph	N	6-SCH ₃	Cl	4-CO ₂ CH ₂ Ph
N	H	CN	2-CO ₂ H	N	H	CN	4-CO ₂ H

TABLE 4



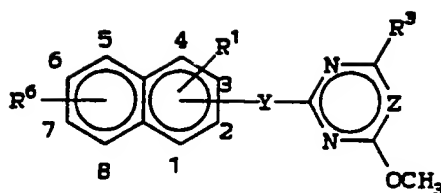
Y	R^1	R^3	Z	Y	R^1	R^3	Z
2- CH_2	CO_2H	OCH_3	CH	4- CH_2	CO_2H	OCH_3	CH
2- CH_2	CO_2CH_3	OCH_3	CH	4- CH_2	CO_2CH_3	OCH_3	CH
2- CH_2	$CO_2CH_2C_6H_5$	OCH_3	CH	4- CH_2	$CO_2CH_2C_6H_5$	OCH_3	CH
2- CH_2	CO_2H	CH_3	CH	4- CH_2	CO_2H	CH_3	CH
2- CH_2	CO_2H	CH_3	N	4- CH_2	CO_2H	CH_3	N
2- $CHCN$	CO_2H	OCH_3	CH	4- $CHCN$	CO_2H	OCH_3	CH
2- $CHCN$	CO_2CH_3	OCH_3	CH	4- $CHCN$	CO_2CH_3	OCH_3	CH
2- $CHCN$	$CO_2CH_2C_6H_5$	OCH_3	CH	4- $CHCN$	$CO_2CH_2C_6H_5$	OCH_3	CH
2- $CHCN$	CO_2H	CH_3	CH	4- $CHCN$	CO_2H	CH_3	CH
2- $CHCN$	CO_2H	CH_3	N	4- $CHCN$	CO_2H	CH_3	N

TABLE 5



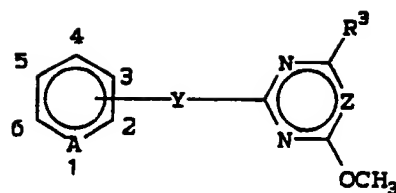
Y	R^1	R^3	Z	Y	R^1	R^3	Z
2-CH ₂	3-CO ₂ H	OCH ₃	CH	3-CH ₂	4-CO ₂ H	OCH ₃	CH
2-CH ₂	3-CO ₂ CH ₃	OCH ₃	CH	3-CH ₂	4-CO ₂ CH ₃	OCH ₃	CH
2-CH ₂	3-CO ₂ CH ₂ C ₆ H ₅	OCH ₃	CH	3-CH ₂	4-CO ₂ CH ₂ C ₆ H ₅	OCH ₃	CH
2-CH ₂	3-CO ₂ H	CH ₃	CH	3-CH ₂	4-CO ₂ H	CH ₃	CH
2-CH ₂	3-CO ₂ H	CH ₃	N	3-CH ₂	4-CO ₂ H	CH ₃	N
2-CHCN	3-CO ₂ H	OCH ₃	CH	3-CHCN	4-CO ₂ H	OCH ₃	CH
2-CHCN	3-CO ₂ CH ₃	OCH ₃	CH	3-CHCN	4-CO ₂ CH ₃	OCH ₃	CH
2-CHCN	3-CO ₂ CH ₂ C ₆ H ₅	OCH ₃	CH	3-CHCN	4-CO ₂ CH ₂ C ₆ H ₅	OCH ₃	CH
2-CHCN	3-CO ₂ H	CH ₃	CH	3-CHCN	4-CO ₂ H	CH ₃	CH
2-CHCN	3-CO ₂ H	CH ₃	N	3-CHCN	4-CO ₂ H	CH ₃	N
6-CH ₂	5-CO ₂ H	OCH ₃	CH	7-CH ₂	8-CO ₂ H	OCH ₃	CH
6-CH ₂	5-CO ₂ CH ₃	OCH ₃	CH	7-CH ₂	8-CO ₂ CH ₃	OCH ₃	CH
6-CH ₂	5-CO ₂ CH ₂ C ₆ H ₅	OCH ₃	CH	7-CH ₂	8-CO ₂ CH ₂ C ₆ H ₅	OCH ₃	CH
6-CH ₂	5-CO ₂ H	CH ₃	CH	7-CH ₂	8-CO ₂ H	CH ₃	CH
6-CH ₂	5-CO ₂ H	CH ₃	N	7-CH ₂	8-CO ₂ H	CH ₃	N
6-CHCN	5-CO ₂ H	OCH ₃	CH	7-CHCN	8-CO ₂ H	OCH ₃	CH
6-CHCN	5-CO ₂ CH ₃	OCH ₃	CH	7-CHCN	8-CO ₂ CH ₃	OCH ₃	CH
6-CHCN	5-CO ₂ CH ₂ C ₆ H ₅	OCH ₃	CH	7-CHCN	8-CO ₂ CH ₂ C ₆ H ₅	OCH ₃	CH
6-CHCN	5-CO ₂ H	CH ₃	CH	7-CHCN	8-CO ₂ H	CH ₃	CH
6-CHCN	5-CO ₂ H	CH ₃	N	7-CHCN	8-CO ₂ H	CH ₃	N

TABLE 6



Y	R ¹	R ³	R ⁶	Z
2-CH ₂	1-CHO	OCH ₃	H	CH
2-CH ₂	1-CO ₂ H	OCH ₃	8-Cl	CH
2-CH ₂	1-CO ₂ H	CH ₃	H	CH
2-CH ₂	1-CO ₂ H	OCH ₃	H	CH
2-CH ₂	1-CO ₂ CH ₃	CH ₃	H	N
2-CH ₂	1-CO ₂ CH ₃	OCH ₃	H	CH
2-CH(OH)	1-CHO	OCH ₃	H	CH
2-CH(OH)	1-CO ₂ H	OCH ₃	H	CH
2-CH(OH)	1-CO ₂ H	CH ₃	H	N
2-CH(OH)	1-CO ₂ CH ₃	OCH ₃	H	CH
2-CH(OH)	1-CO ₂ CH ₂ C ₆ H ₅	OCH ₃	H	CH
2-CHCl	1-CHO	OCH ₃	H	CH
2-CHCl	1-CO ₂ H	OCH ₃	H	CH
2-CHCl	1-CO ₂ H	CH ₃	H	CH
2-CHCl	1-CO ₂ CH ₃	OCH ₃	H	N
2-CHCl	1-CO ₂ CH ₃	OCH ₃	H	CN
2-CHCN	1-CHO	OCH ₃	H	CH
2-CHCN	1-CO ₂ H	OCH ₃	H	CH
2-CHCN	1-CO ₂ H	OCH ₃	6-Cl	CH
2-CHCN	1-CO ₂ Na	OCH ₃	H	CH
2-CHCN	1-CO ₂ Na	OCH ₃	H	N

TABLE 7



A	Y	R ³	Z	A	Y	R ³	Z
CH	2-CHCO ₂ CH ₃	OCH ₃	CH	N	2-CHCO ₂ CH ₃	OCH ₃	CH
CH	2-CHCO ₂ CH ₂ CH ₃	OCH ₃	CH	N	2-CHCO ₂ CH ₂ CH ₃	OCH ₃	CH
CH	2-CHCO ₂ CH ₂ CH ₃	CH ₃	CH	N	2-CHCO ₂ CH ₂ CH ₃	CH ₃	CH
CH	2-CHCO ₂ CH ₂ CH ₃	CH ₃	N	N	2-CHCO ₂ CH ₂ CH ₃	CH ₃	N
CH	2-CHCO ₂ CH ₂ CH ₃	N(CH ₃) ₂	CH	N	2-CHCO ₂ CH ₂ CH ₃	N(CH ₃) ₂	CH
CH	2-CHCO ₂ CH ₂ CH ₂ CH ₃	OCH ₃	CH	N	2-CHCO ₂ CH ₂ CH ₂ CH ₃	OCH ₃	CH
CH	2-CHCO ₂ CH ₂ C ₆ H ₄	OCH ₃	CH	N	2-CHCO ₂ CH ₂ C ₆ H ₄	OCH ₃	CH
CH	2-CHCO ₂ CH ₂ C ₆ H ₄	CH ₃	N	N	2-CHCO ₂ CH ₂ C ₆ H ₄	CH ₃	N
CH	2-CHCO ₂ CH ₂ CH=CH ₂	CH ₃	CH	N	2-CHCO ₂ CH ₂ CH=CH ₂	CH ₃	CH
CH	2-CHCO ₂ CH ₂ CH=CH ₂	OCH ₃	CH	N	2-CHCO ₂ CH ₂ CH=CH ₂	OCH ₃	CH
CH	2-CHCO ₂ CH ₂ C≡CH	OCH ₃	CH	N	2-CHCO ₂ CH ₂ C≡CH	OCH ₃	CH
C-CH ₃	2-CO ₂ CH ₂ CH ₃	OCH ₃	CH	N-O	2-CO ₂ CH ₂ CH ₃	OCH ₃	CH
C-OCH ₃	3-CO ₂ CH ₂ CH ₃	OCH ₃	CH	N-O	3-CO ₂ CH ₂ CH ₃	OCH ₃	CH
C-Cl	3-CO ₂ CH ₂ CH ₃	OCH ₃	CH	N-O	3-CO ₂ CH ₂ CH ₃	OCH ₃	CH
C-F	3-CO ₂ CH ₂ CH ₃	OCH ₃	CH				

Formulations

Useful formulations of the compounds of Formula I can be prepared in conventional ways. They include dusts, granules, pellets, solutions, suspensions, emulsions, wettable powders, emulsifiable concentrates and the like. Many of these may be applied directly. Sprayable formulations can be extended in suitable media and used at spray volumes of from a few liters to several hundred liters per hectare. High strength compositions are primarily used as intermediates for further formulation. The formulations, broadly, contain about 0.1% to 99% by weight of active ingredient(s) and at least one of (a) about 0.1% to 20% surfactant(s) and (b) about 1% to 99.9% solid or liquid diluent(s). More specifically, they will contain these ingredients in the following approximate proportions:

Table 8

		Weight Percent*		
		Active Ingredient	Diluent(s)	Surfactant(s)
25	Wettable Powders	20-90	0-74	1-10
	Oil Suspensions, Emulsions, Solutions, (including Emulsifiable Concentrates)	3-50	40-95	0-15
	Aqueous Suspension	10-50	40-84	1-20
30	Dusts	1-25	70-99	0-5
	Granules and Pellets	0.1-95	5-99.9	0-15
	High Strength Compositions	90-99	0-10	0-2

* Active ingredient plus at least one of a Surfactant or a Diluent equals 100 weight percent.

Lower or higher levels of active ingredient can, of course, be present depending on the intended use and the physical properties of the compound. Higher ratios of surfactant to active ingredient are sometimes desirable, and are achieved by incorporation into the formulation or by tank mixing.

Typical solid diluents are described in Watkins, et al., "Handbook of Insecticide Dust Diluents and Carriers", 2nd Ed., Dorland Books, Caldwell, New Jersey, but other solids, either mined or manufactured, may be used. The more absorptive diluents are preferred for wettable powders and the denser ones for dusts. Typical liquid diluents and solvents are described in Marsden, "Solvents Guide," 2nd Ed., Interscience, New York, 1950. Solubility under 0.1% is preferred for suspension concentrates; solution concentrates are preferably stable against phase separation at 0°C. "McCutcheon's Detergents and Emulsifiers Annual", MC Publishing Corp., Ridgewood, New Jersey, as well as Sisely and Wood, "Encyclopedia of Surface Active Agents", Chemical Publishing Co., Inc., New York, 1964, list surfactants and recommended uses. All formulations can contain minor amounts of additives to reduce foaming, caking, corrosion, microbiological growth, etc.

The methods of making such compositions are well known. Solutions are prepared by simply mixing the ingredients. Fine solid compositions are made by blending and, usually, grinding as in a hammer or fluid energy mill. Suspensions are prepared by wet milling (see, for example, Littler, U.S. Patent 3,060,084). Granules and pellets may be made by spraying the active material upon preformed granular carriers or by agglomeration techniques. See J. E.

Browning, "Agglomeration", Chemical Engineering,
December 4, 1967, pp. 147ff. and "Perry's Chemical
5 Engineer's Handbook", 5th Ed., McGraw-Hill, New York,
1973, pp. 8-57ff.

For further information regarding the art of
formulation, see for example:

H. M. Loux, U.S. Patent 3,235,361, February 15,
10 1966, Col. 6, line 16 through Col. 7, line 19 and
Examples 10 through 41;

R. W. Luckenbaugh, U.S. Patent 3,309,192,
March 14, 1967, Col. 5, line 43 through Col. 7, line
62 and Examples 8, 12, 15, 39, 41, 52, 53, 58, 132,
15 138-140, 162-164, 166, 167 and 169-182;

H. Gysin and E. Knusli, U.S. Patent 2,891,855,
June 23, 1959, Col. 3, line 66 through Col. 5, line 17
and Examples 1-4;

G. C. Klingman, "Weed Control as a Science",
20 John Wiley and Sons, Inc., New York, 1961, pp. 81-96;
and

J. D. Fryer and S. A. Evans, "Weed Control Hand-
book", 5th Ed., Blackwell Scientific Publications,
Oxford, 1968, pp. 101-103.

25 In the following examples, all parts are by
weight unless otherwise indicated.

Example A

Wettable Powder

30	2-[4,6-dimethoxy-2-pyrimidinyl)methyl]-6- methyl-benzoic acid	80%
	sodium alkyl naphthalenesulfonate	2%
	sodium ligninsulfonate	2%
	synthetic amorphous silica	3%
35	kaolinite	13%

The ingredients are blended, hammer-milled
until all the solids are essentially under 50
microns, reblended, and packaged.

Example BWettable Powder

- 5 2-[4,6-dimethoxy-2-pyrimidinyl)methyl]-6-methyl-benzoic acid 50%
- sodium alkylnaphthalenesulfonate 2%
- low viscosity methyl cellulose 2%
- diatomaceous earth 46%
- 10 The ingredients are blended, coarsely hammer-milled and then air-milled to produce particles essentially all below 10 microns in diameter. The product is reblended before packaging.

15

Example CGranule

- Wettable Powder of Example B 5%
- attapulgate granules 95%
- (U.S.S. 20-40 mesh; 0.84-0.42 mm)
- 20 A slurry of wettable powder containing 25% solids is sprayed on the surface of attapulgate granules in a double-cone blender. The granules are dried and packaged.

25

Example DExtruded Pellet

- 2-[4,6-dimethoxy-2-pyrimidinyl)methyl]-6-methyl-benzoic acid 25%
- anhydrous sodium sulfate 10%
- 30 crude calcium ligninsulfonate 5%
- sodium alkylnaphthalenesulfonate 1%
- calcium/magnesium bentonite 59%
- The ingredients are blended, hammer-milled and then moistened with about 12% water. The mixture is
- 35 extruded as cylinders about 3 mm diameter which are cut to produce pellets about 3 mm long. These may be

used directly after drying, or the dried pellets may be crushed to pass a U.S.S. No. 20 sieve (0.84 mm openings). The granules held on a U.S.S. No. 40 sieve (0.42 mm openings) may be packaged for use and the fines recycled.

Example E

10 Oil Suspension

2-[4,6-dimethoxy-2-pyrimidinyl)methyl]-6-methyl-benzoic acid 25%
polyoxyethylene sorbitol hexaoleate 5%
highly aliphatic hydrocarbon oil 70%

15 The ingredients are ground together in a sand mill until the solid particles have been reduced to under about 5 microns. The resulting thick suspension may be applied directly, but preferably after being extended with oils or emulsified in water.

20

Example F

Wettable Powder

2-[4,6-dimethoxy-2-pyrimidinyl)methyl]-6-methyl-benzoic acid 20%
25 sodium alkylnaphthalenesulfonate 4%
sodium ligninsulfonate 4%
low viscosity methyl cellulose 3%
attapulgate 69%

30 The ingredients are thoroughly blended. After grinding in a hammer-mill to produce particles essentially all below 100 microns, the material is reblended and sifted through a U.S.S. No. 50 sieve (0.3 mm opening) and packaged.

35

Example GLow Strength Granule

5	2-[4,6-dimethoxy-2-pyrimidinyl)methyl]-6-methyl-benzoic acid	1%
	N,N-dimethylformamide	9%
	attapulgitic granules	90%
	(U.S.S. 20-40 sieve)	

10 The active ingredient is dissolved in the solvent and the solution is sprayed upon dedusted granules in a double cone blender. After spraying of the solution has been completed, the blender is allowed to run for a short period and then the granules are packaged.

15

Example HAqueous Suspension

	2-[4,6-dimethoxy-2-pyrimidinyl)methyl]-6-methyl-benzoic acid	40%
20	polyacrylic acid thickener	0.3%
	dodecylphenol polyethylene glycol ether	0.5%
	disodium phosphate	1%
	monosodium phosphate	0.5%
	polyvinyl alcohol	1.0%
25	water	56.7%

The ingredients are blended and ground together in a sand mill to produce particles essentially all under 5 microns in size.

30

Example ISolution

	2-[4,6-dimethoxy-2-pyrimidinyl)methyl]-6-methyl-benzoic acid	5%
	water	95%

35

The salt is added directly to the water with stirring to produce the solution, which may then be packaged for use.

Example JLow Strength Granule

5	2-[4,6-dimethoxy-2-pyrimidinyl)methyl]-6-methyl-benzoic acid	0.1%
	attapulgate granules	99.9%
	(U.S.S. 20-40 mesh)	

10 The active ingredient is dissolved in a solvent and the solution is sprayed upon dedusted granules in a double-cone blender. After spraying of the solution has been completed, the material is warmed to evaporate the solvent. The material is allowed to cool and then packaged.

15

Example KGranule

	2-[4,6-dimethoxy-2-pyrimidinyl)methyl]-6-methyl-benzoic acid	80%
20	wetting agent	1%
	crude ligninsulfonate salt (containing 5-20% of the natural sugars)	10%
	attapulgate clay	9%

25 The ingredients are blended and milled to pass through a 100 mesh screen. This material is then added to a fluid bed granulator, the air flow is adjusted to gently fluidize the material, and a fine spray of water is sprayed onto the fluidized material. The fluidization and spraying are continued until granules of the
30 desired size range are made. The spraying is stopped, but fluidization is continued, optionally with heat, until the water content is reduced to the desired level, generally less than 1%. The material is then discharged, screened to the desired size range,
35 generally 14-100 mesh (1410-149 microns), and packaged for use.

Example LHigh Strength Concentrate

5	2-[4,6-dimethoxy-2-pyrimidinyl)methyl]-6-methyl-benzoic acid	99%
	silica aerogel	0.5%
	synthetic amorphous silica	0.5%

10 The ingredients are blended and ground in a hammer-mill to produce a material essentially all passing a U.S.S. No. 50 screen (0.3 mm opening). The concentrate may be formulated further if necessary.

Example MWettable Powder

15	2-[4,6-dimethoxy-2-pyrimidinyl)methyl]-6-methyl-benzoic acid	90%
	dioctyl sodium sulfosuccinate	0.1%
	synthetic fine silica	9.9%

20 The ingredients are blended and ground in a hammer-mill to produce particles essentially all below 100 microns. The material is sifted through a U.S.S. No. 50 screen and then packaged.

25

Example NWettable Powder

	2-[4,6-dimethoxy-2-pyrimidinyl)methyl]-6-methyl-benzoic acid	40%
	sodium ligninsulfonate	20%
30	montmorillonite clay	40%

The ingredients are thoroughly blended, coarsely hammer-milled and then air-milled to produce particles essentially all below 10 microns in size. The material is reblended and then packaged.

35

Example OOil Suspension

5	2-[4,6-dimethoxy-2-pyrimidinyl)methyl]-6-methyl-benzoic acid	35%
	blend of polyalcohol carboxylic esters and oil soluble petroleum sulfonates	6%
10	xylene	59%

The ingredients are combined and ground together in a sand mill to produce particles essentially all below 5 microns. The product can be used directly, extended with oils, or emulsified in water.

15

Example PDust

	2-[4,6-dimethoxy-2-pyrimidinyl)methyl]-6-methyl-benzoic acid	10%
20	attapulgate	10%
	Pyrophyllite	80%

The active ingredient is blended with attapulgate and then passed through a hammer-mill to produce particles substantially all below 200 microns. The ground concentrate is then blended with powdered pyrophyllite until homogeneous.

25

Example QEmulsifiable Concentrate

30	2-[4,6-dimethoxy-2-pyrimidinyl)methyl]-6-methyl-benzoic acid	10%
	chlorobenzene	84%
	sorbitan monostearate and polyoxyethylene condensates thereof	6%

The ingredients are combined and stirred to produce a solution which can be emulsified in water for application.

35

Utility

Test results indicate that compounds of this invention are active postemergence and preemergence herbicides. These compounds are useful for the control of selected grass and broadleaf weeds with tolerance to important agronomic crops which include, but are not limited to barley (Hordeum vulgare), corn (Zea mays), cotton (Gossypium hirsutum), and wheat (Triticum aestivum). Weed species controlled include, but are not limited to cocklebur (Xanthium pensylvanicum), teaweed (Sida spinosa), and velvetleaf (Abutilon theophrasti).

These compounds also have utility for complete control and/or selected control of vegetation in specified areas such as around storage tanks, parking lots, highways, and railways, and in fallow crop, citrus, and plantation crop areas. Alternatively, these compounds are useful to modify plant growth.

A herbicidally effective amount of the compounds of this invention is determined by a number of factors. These factors include: formulation selected, method of application, amount and type of vegetation present, growing conditions, etc. In general terms, a herbicidally effective amount of the compounds of the invention is applied at rates from 0.004 to 20 kg/ha with a preferred rate range of 0.025 to 2 kg/ha. One skilled in the art can easily determine the application rate needed for the desired level of weed control.

Compounds of this invention may be used alone or in combination with other commercial herbicides, insecticides, or fungicides. The following list exemplifies some of the herbicides suitable for use in mixtures. A combination of a compound from this invention with one or more of the following herbicides may be particularly useful for weed control.

	<u>Common Name</u>	<u>Chemical Name</u>
5	acetochlor	2-chloro-N-(ethoxymethyl)-N-(2-ethyl-6-methylphenyl)acetamide
	acifluorfen	5-[2-chloro-4-(trifluoromethyl)-phenoxy]-2-nitrobenzoic acid
	acrolein	2-propenal
10	alachlor	2-chloro-N-(2,6-diethylphenyl)-N-(methoxymethyl)acetamide
	anilofos	S-4-chloro-N-isopropylcarbaniloyl-methyl-O,O-dimethyl phosphorodithioate
15	ametryn	N-ethyl-N'-(1-methylethyl)-6-(methylthio)-1,3,5-triazine-2,4-diamine
	amitrole	1H-1,2,4-triazol-3-amine
	AMS	ammonium sulfamate
20	asulam	methyl [(4-aminophenyl)sulfonyl]-carbamate
	atrazine	6-chloro-N-ethyl-N'-(1-methylethyl)-1,3,5-triazine-2,4-diamine
	barban	4-chloro-2-butynyl 3-chlorocarbamate
25	benefin	N-butyl-N-ethyl-2,6-dinitro-4-(trifluoromethyl)benzenamine
	bensulfuron methyl	2-[[[[(4,6-dimethoxy-2-pyrimidinyl)amino]methylcarbonyl]-amino]sulfonyl]methyl]benzoic acid, methyl ester
30	bensulide	O,O-bis(1-methylethyl) S-[2-[(phenylsulfonyl)amino]-ethyl]phosphorodithioate
	bentazon	3-(1-methylethyl)-(1H)-2,1,3-benzothiadiazin-4(3H)-one, 2,2-dioxide
35	benzofluor	N-[4-(ethylthio)-2-(trifluoromethyl)phenyl]methanesulfonamide

	<u>Common Name</u>	<u>Chemical Name</u>
5	benzoylprop	N-benzoyl-N-(3,4-dichlorophenyl)-DL-alanine
	bifenox	methyl 5-(2,4-dichlorophenoxy)-2-nitrobenzoate
	bromacil	5-bromo-6-methyl-3-(1-methylpropyl)-2,4(1H,3H)pyrimidinedione
10	bromoxynil	3,5-dibromo-4-hydroxybenzonitrile
	butachlor	N-(butoxymethyl)-2-chloro-N-(2,6-diethylphenyl)acetamide
15	buthidazole	3-[5-(1,1-dimethylethyl)-1,3,4-thiadiazol-2-yl]-4-hydroxy-1-methyl-2-imidazolidinone
	butralin	4-(1,1-dimethylethyl)-N-(1-methylpropyl)-2,6-dinitrobenzenamine
	butylate	S-ethyl bis(2-methylpropyl)-carbamothioate
20	cacodylic acid	dimethyl arsinic oxide
	CDAA	2-chloro-N,N-di-2-propenylacetamide
	CDEC	2-chloroallyl diethyldithiocarbamate
25	CGA 142,464	3-(4,6-dimethoxy-1,3,5-triazin-2-yl)-1-[2-(2-methoxyethoxy)-phenyl-sulfonyl]-urea
	chloramben	3-amino-2,5-dichlorobenzoic acid
30	chlorbromuron	3-(4-bromo-3-chlorophenyl)-1-methoxy-1-methylurea
	chlorimuron ethyl	2-[[[(4-chloro-6-methoxy-2-pyrimidinyl)ethylamino]carbonyl]-amino]sulfonyl]benzoic acid, ethyl ester
35	chlormethoxy-nil	2,4-dichlorophenyl 4-nitro-3-methoxyphenyl ether
	chlornitrofen	2,4,6-trichlorophenyl-4-nitrophenyl ether

	<u>Common Name</u>	<u>Chemical Name</u>
5	chloroxuron	N'-[4-(4-chlorophenoxy)phenyl]-N,N-dimethylurea
	chlorpropham	1-methylethyl 3-chlorophenylcarbamate
	chlorsulfuron	2-chloro-N-[[4-methoxy-6-methyl-1,3,5-triazin-2-yl)amino]carbonyl]benzenesulfonamide
10	chlortoluron	N'-(3-chloro-4-methylphenyl)-N,N-dimethylurea
	cinmethylin	exo-1-methyl-4-(1-methylethyl)-2-[(2-methylphenyl)methoxy]-7-oxabicyclo-[2.2.1]heptane
15	clethodim	(E,E)-(±)-2-[1-[[3-chloro-2-propenyl)oxy]imino]propyl]-5-[2-(ethylthio)propyl]-3-hydroxy-2-cyclohexen-1-one
	clomazone	2-[(2-chlorophenyl)methyl]-4,4-dimethyl-3-isoxazolidinone
20	cloproxydim	(E,E)-2-[1-[[3-chloro-2-propenyl)oxy]imino]butyl]-5-[2-(ethylthio)propyl]-3-hydroxy-2-cyclohexen-1-one
	clopyralid	3,6-dichloro-2-pyridinecarboxylic acid
	CMA	calcium salt of MAA
25	cyanazine	2-[[4-chloro-6-(ethylamino)-1,3,5-triazin-2-yl]amino]-2-methylpropanenitrile
	cycloate	S-ethyl cyclohexylethylcarbamothioate
	cycluron	3-cyclooctyl-1,1-dimethylurea
30	cyperquat	1-methyl-4-phenylpyridinium
	cyprazine	2-chloro-4-(cyclopropylamino)-6-(isopropylamino)-s-triazine
	cyprazole	N-[5-(2-chloro-1,1-dimethylethyl)-1,3,4-thiadiazol-2-yl]cyclopropanecarboxamide
35	cypromid	3',4'-dichlorocyclopropanecarboxanilide

	<u>Common Name</u>	<u>Chemical Name</u>
5	dalapon	2,2-dichloropropanoic acid
	dazomet	tetrahydro-3,5-dimethyl-2H-1,3,5-thia- diazine-2-thione
	DCPA	dimethyl 2,3,5,6-tetrachloro-1,4-benzene- dicarboxylate
10	desmediphan	ethyl [3-[[[(phenylamino)carbonyl]oxy]- phenyl]carbamate
	desmetryn	2-(isopropylamino)-4-(methylamino)-6- (methylthio)-s-triazine
	diallate	S-(2,3-dichloro-2-propenyl)bis(1- methylethyl)carbamothioate
15	dicamba	3,6-dichloro-2-methoxybenzoic acid
	dichlobenil	2,6-dichlorobenzonitrile
	dichlorprop	(±)-2-(2,4-dichlorophenoxy)propanoic acid
20	diclofop- methyl	(±)-2-[4-(2,4-dichlorophenoxy)phenoxy]- propanoic acid, methyl ester
	diethatyl	N-(chloroacetyl)-N-(2,6-diethylphenyl)- glycine
	difenzoquat	1,2-dimethyl-3,5-diphenyl-1H-pyrazolium
25	dimepiperate	S-1-methyl-1-phenylethylpiperidine- 1-carbothioate
	dinitramine	N ³ ,N ³ -diethyl-2,4-dinitro-6-(trifluoro- methyl)-1,3-benzenediamine
	dinoseb	2-(1-methylpropyl)-4,6-dinitrophenol
30	diphenamid	N,N-dimethyl-α-phenylbenzeneacetamide
	dipropetryn	6-(ethylthio)-N,N'-bis(1-methylethyl)- 1,3,5-triazine-2,4-diamine
	diquat	6,7-dihydrodipyrido[1,2-a:2',1'-c]- pyrazinedium ion
35	diuron	N'-(3,4-dichlorophenyl)-N,N-dimethylurea

	<u>Common Name</u>	<u>Chemical Name</u>
5	DNOC	2-methyl-4,6-dinitrophenol
	DSMA	disodium salt of MAA
	dymron	N-(4-methylphenyl)-N'-(1-methyl-1-phenylethyl)urea
10	endothall	7-oxabicyclo[2.2.1]heptane-2,3-dicarboxylic acid
	EPTC	S-ethyl dipropylcarbamoithioate
	esprocarb (SC2957)	S-benzyl-N-ethyl-N-(1,2-dimethyl)-propylthiolcarbamate
15	ethalfluralin	N-ethyl-N-(2-methyl-2-propenyl)-2,6-dinitro-4-(trifluoromethyl)-benzenamine
	ethofumesate	(±)-2-ethoxy-2,3-dihydro-3,3-dimethyl-5-benzofuranyl methanesulfonate
	fenac	2,3,6-trichlorobenzeneacetic acid
20	fenoxaprop	(±)-2-[4-[(6-chloro-2-benzoxazolyl)oxy]phenoxy]propanoic acid
	fenuron	N,N-dimethyl-N'-phenylurea
	fenuron TCA	Salt of fenuron and TCA
25	flamprop	N-benzoyl-N-(3-chloro-4-fluorophenyl)-DL-alanine
	fluazifop	(±)-2-[4-[[5-(trifluoromethyl)-2-pyridinyl]oxy]phenoxy]propanoic acid
	fluazifop-P	(R)-2-[4-[[5-(trifluoromethyl)-2-pyridinyl]oxy]phenoxy]propanoic acid
30	fluchloralin	N-(2-chloroethyl)-2,6-dinitro-N-propyl-4-(trifluoromethyl)benzenamine
	fluometuron	N,N-dimethyl-N'-[3-(trifluoromethyl)-phenyl]urea
35		

	<u>Common Name</u>	<u>Chemical Name</u>
5	fluorochloridone	3-chloro-4-(chloromethyl)-1-[3-(trifluoromethyl)phenyl]-2-pyrrolidinone
	fluorodifen	p-nitrophenyl α,α,α -trifluoro-2-nitro-p-tolyl ether
10	fluoroglycofen	carboxymethyl 5-[2-chloro-4-(trifluoromethyl)phenoxy]-2-nitrobenzoate
	fluridone	1-methyl-3-phenyl-5-[3-(trifluoromethyl)phenyl]-4(1H)-pyridinone
	fomesafen	5-[2-chloro-4-(trifluoromethyl)phenoxy]-N-(methylsulfonyl)-2-nitrobenzamide
15	fosamine	ethyl hydrogen (aminocarbonyl)-phosphate
	glyphosate	N-(phosphonomethyl)glycine
	haloxyfop	2-[4-[[3-chloro-5-(trifluoromethyl)-2-pyridinyl]oxy]phenoxy]propanoic acid
20	hexaflurate	potassium hexafluoroarsenate
	hexazinone	3-cyclohexyl-6-(dimethylamino)-1-methyl-1,3,5-triazine-2,4(1H,3H)-dione
25	imazamethabenz	6-(4-isopropyl-4-methyl-5-oxo-2-imidazolin-2-yl)-m-toluic acid, methyl ester and 6-(4-isopropyl-4-methyl-5-oxo-2-imidazolin-2-yl)-p-toluic acid, methyl ester
	imazapyr	(\pm)-2-[4,5-dihydro-4-methyl-4-(1-methylethyl)-5-oxo-1H-imidazol-2-yl]-3-pyridinecarboxylic acid
30	imazaquin	2-[4,5-dihydro-4-methyl-4-(1-methylethyl)-5-oxo-1H-imidazol-2-yl]-3-quinolinecarboxylic acid
	imazethapyr	(\pm)-2-[4,5-dihydro-4-methyl-4-(1-methylethyl)-5-oxo-1H-imidazol-2-yl]-5-ethyl-3-pyridinecarboxylic acid
35		

	<u>Common Name</u>	<u>Chemical Name</u>
5	ioxynil	4-hydroxy-3,5-diiodobenzonitrile
	isopropalin	4-(1-methylethyl)-2,6-dinitro-N,N-, dipropylbenzenamine
	isoproturon	N-(4-isopropylphenyl)-N',N'-dimethylurea
	isouron	N'-[5-(1,1-dimethylethyl)-3-isoxazolyl]- N,N-dimethylurea
	isoxaben	N-[3-(1-ethyl-1-methylpropyl)-5- isoxazolyl]-2,6-dimethoxybenzamide
15	karbutilate	3-[[(dimethylamino) carbonyl] amino]- phenyl-(1,1-dimethylethyl) carbamate
	lactofen	(±)-2-ethoxy-1-methyl-2-oxoethyl 5-[2- chloro-4-(trifluoromethyl)phenoxy]- 2-nitrobenzoate
	lenacil	3-cyclohexyl-6,7-dihydro-1H-cyclopenta- pyrimidine-2,4(3H,5H)-dione
	linuron	N'-(3,4-dichlorophenyl)-N-methoxy-N- methylurea
20	MAA	methylarsonic acid
	MAMA	monoammonium salt of MAA
	MCPA	(4-chloro-2-methylphenoxy)acetic acid
	MCPB	4-(4-chloro-2-methylphenoxy)butanoic acid
	MON 7200	S,S-dimethyl-2-(difluoromethyl)-4- (2-methylpropyl)-6-(trifluoromethyl)- 3,5-pyridinedicarbothionate
30	mecoprop	(±)-2-(4-chloro-2-methylphenoxy)- propanoic acid
	mefenacet	2-(2-benzothiazolyloxy-N-methyl-N- phenylacetamide
	mefluidide	N-[2,4-dimethyl-5-[[(trifluoromethyl)- sulfonyl] amino] phenyl] acetamide
35	methal- propalin	N-(2-methyl-2-propenyl)-2,6-dinitro-N- propyl-4-(trifluoromethyl)benzenamide

	<u>Common Name</u>	<u>Chemical Name</u>
5	methabenz-thiazuron	1,3-dimethyl-3-(2-benzothiazolyl)urea
	metham	methylcarbamodithioic acid
	methazole	2-(3,4-dichlorophenyl)-4-methyl-1,2,4-oxadiazolidine-3,5-dione
10	methoxuron	N'-(3-chloro-4-methoxyphenyl)-N,N-dimethylurea
	metolachlor	2-chloro-N-(2-ethyl-6-methylphenyl)-N-(2-methoxy-1-methylethyl)acetamide
	metribuzin	4-amino-6-(1,1-dimethylethyl)-3-(methylthio)-1,2,4-triazin-5(4H)-one
15	metsulfuron methyl	2-[[[(4-methoxy-6-methyl-1,3,5-triazin-2-yl)amino]carbonyl]-amino]sulfonyl]benzoic acid, methyl ester
	MH	1,2-dihydro-3,6-pyridazinedione
20	molinate	S-ethyl hexahydro-1H-azepine-1-carbothioate
	monolinuron	3-(p-chlorophenyl)-1-methoxy-1-methylurea
25	monuron	N'-(4-chlorophenyl)-N,N-dimethylurea
	monuron TCA	Salt of monuron and TCA
	MSMA	monosodium salt of MAA
	napropamide	N,N-diethyl-2-(1-naphthalenyloxy)-propanamide
30	naptalam	2-[(1-naphthalenylamino)carbonyl]-benzoic acid
	neburon	1-butyl-3-(3,4-dichlorophenyl)-1-methylurea
35	nitralin	4-(methylsulfonyl)-2,6-dinitro-N,N-dipropylaniline
	nitrofen	2,4-dichloro-1-(4-nitrophenoxy)benzene

	<u>Common Name</u>	<u>Chemical Name</u>
5	nitrofluorfen	2-chloro-1-(4-nitrophenoxy)-4-(trifluoromethyl)benzene
	norea	N,N-dimethyl-N'-(octahydro-4,7-methano-1H-inden-5-yl)urea 3 α , -4 α , 5 α , 7 α , 7 $\alpha\alpha$ -isomer
10	norflurazon	4-chloro-5-(methylamino)-2-[3-(trifluoromethyl)phenyl]-3(2H)-pyridazinone
	oryzalin	4-(dipropylamino)-3,5-dinitrobenzenesulfonamide
15	oxadiazon	3-[2,4-dichloro-5-(1-methylethoxy)-phenyl]-5-(1,1-dimethylethyl)-1,3,4-oxadiazol-2(3H)-one
	oxyfluorfen	2-chloro-1-(3-ethoxy-4-nitrophenoxy)-4-(trifluoromethyl)benzene
	paraquat	1,1'-dimethyl-4,4'-dipyridinium ion
20	pebulate	S-propyl butylethylcarbamoithioate
	pendimethalin	N-(1-ethylpropyl)-3,4-dimethyl-2,6-dinitrobenzenamine
	perfluidone	1,1,1-trifluoro-N-[2-methyl-4-(phenylsulfonyl)phenyl]methanesulfonamide
25	phenmedipham	3-[(methoxycarbonyl)amino]phenyl (3-methylphenyl)carbamate
	picloram	4-amino-3,5,6-trichloro-2-pyridine-carboxylic acid
30	PPG-1013	5-[2-chloro-4-(trifluoromethyl)-phenoxy]-2-nitroacetophenone oxime-O-acetic acid, methyl ester
	pretilachlor	α -chloro-2,6-diethyl-N-(2-propoxyethyl)acetanilide
35	procyazine	2-[[4-chloro-6-(cyclopropylamino)-1,3,5-triazine-2-yl]amino]-2-methylpropane-nitrile
	profluralin	N-(cyclopropylmethyl)-2,6-dinitro-N-propyl-4-(trifluoromethyl)benzenamine

	<u>Common Name</u>	<u>Chemical Name</u>
5	prometon	6-methoxy-N,N'-bis(1-methylethyl)-1,3,5-triazine-2,4-diamine
	prometryn	N,N'-bis(1-methylethyl)-6-(methylthio)-1,3,5-triazine-2,4-diamine
	pronamide	3,5-dichloro-N-(1,1-dimethyl-2-propynyl)benzamide
10	propachlor	2-chloro-N-(1-methylethyl)-N-phenylacetamide
	propanil	N-(3,4-dichlorophenyl)propanamide
	propazine	6-chloro-N,N'-bis(1-methylethyl)-1,3,5-triazine-2,4-diamine
15	propham	1-methylethyl phenylcarbamate
	prosulfalin	N-[[4-(dipropylamino)-3,5-dinitrophenyl]sulfonyl]-S,S-dimethylsulfilimine
20	prynachlor	2-chloro-N-(1-methyl-2-propynyl)acetanilide
	pyrazolate	4-(2,4-dichlorobenzoyl)-1,3-dimethylpyrazol-5-yl-p-toluenesulphonate
	pyrazon	5-amino-4-chloro-2-phenyl-3(2H)-pyridazinone
25	pyrazosulfuron ethyl	ethyl S-[3-(4,6-dimethoxypyrimidin-2-yl)ureadosulfonyl]-1-methylpyrazole-4-carboxylate
	quinclorac	3,7-dichloro-8-quinoline carboxylic acid
30	quizalofop ethyl	(±)-2-[4-[(6-chloro-2-quinoxalinyloxy]phenoxy]propanoic acid, ethyl ester
	secbumeton	N-ethyl-6-methoxy-N'-(1-methylpropyl)-1,3,5-triazine-2,4-diamine
35	sethoxydim	2-[1-(ethoxyimino)butyl]-5-[2-(ethylthio)propyl]-3-hydroxy-2-cyclohexen-1-one
	siduron	N-(2-methylcyclohexyl)-N'-phenylurea

	<u>Common Name</u>	<u>Chemical Name</u>
5	simazine	6-chloro-N,N'-diethyl-1,3,5-triazine-2,4-diamine
	SK-233	1-(α,α -dimethylbenzyl)-3-(4-methylphenyl)urea
10	sulfometuron methyl	2-[[[(4,6-dimethyl-2-pyrimidinyl)-amino]carbonyl]amino]sulfonyl]-benzoic acid, methyl ester
	TCA	trichloroacetic acid
	tebuthiuron	N-[5-(1,1-dimethylethyl)-1,3,4-thiadiazol-2-yl]-N,N'-dimethylurea
15	terbacil	5-chloro-3-(1,1-dimethylethyl)-6-methyl-2,4(1H,3H)-pyrimidinedione
	terbuchlor	N-(butoxymethyl)-2-chloro-N-[2-(1,1-dimethylethyl)-6-methylphenyl]-acetamide
20	terbuthylazine	2-(tert -butylamino)-4-chloro-6-(ethylamino)-s-triazine
	terbutol	2,6-di- tert -butyl-p-tolyl methylcarbamate
	terbutryn	N-(1,1-dimethylethyl)-N'-ethyl-6-(methylthio)-1,3,5-triazine-2,4-diamine
25	thifensulfuron methyl	3-[[[(4-methoxy-6-methyl-1,3,5-triazin-2-yl)amino]carbonyl]amino]sulfonyl]-2-thiophenecarboxylic acid, methyl ester
30	thiobencarb	S-[(4-chlorophenyl)methyl] diethylcarbamothioate
	triallate	S-(2,3,3-trichloro-2-propenyl) bis(1-methylethyl)carbamothioate
35	tribenuron methyl	2-[[[N-(4-methoxy-6-methyl-1,3,5-triazine-2-yl)-N-methylamino]carbonyl]amino]sulfonyl]benzoic acid, methyl ester

	<u>Common Name</u>	<u>Chemical Name</u>
5	triclopyr	[(3,5,6-trichloro-2-pyridinyl)-oxy]acetic acid
	tridiphane	2-(3,5-dichlorophenyl)-2-(2,2,2-trichloroethyl)oxirane
	trifluralin	2,6-dinitro-N,N-dipropyl-4-(trifluoromethyl)benzenamine
10	trimeturon	1-(p-chlorophenyl)-2,3,3-trimethylpseudourea
	2,4-D	(2,4-dichlorophenoxy)acetic acid
	2,4-DB	4-(2,4-dichlorophenoxy)butanoic acid
15	vernolate	S-propyl dipropylcarbamothioate
	xylachlor	2-chloro-N-(2,3-dimethylphenyl)-N-(1-methylethyl)acetamide

Herbicidal properties of the compounds that follow were determined in greenhouse tests. Test results and procedures follow.

25

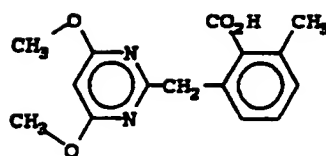
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35

TABLE OF COMPOUNDS

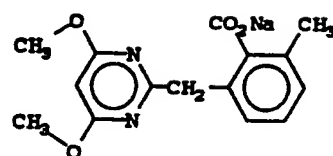
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Compound 1

m p. 122-124°C

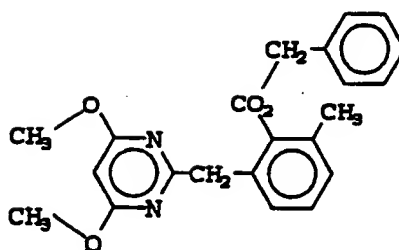


Compound 2

m p. 180-190°C

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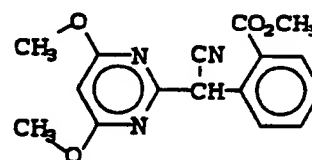
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Compound 3

oil

25



Compound 4

m p. 79-81°C

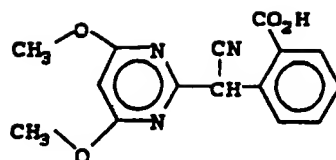
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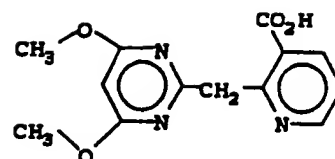
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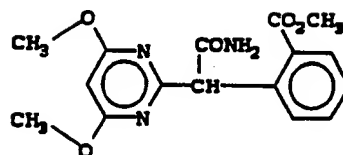
Compound 5
m p. 214-216°C



Compound 6
m p. 182-186°C

15

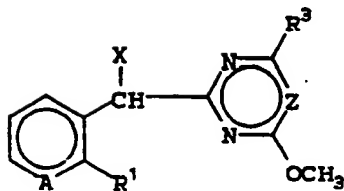
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Compound 9
m p. 120-122°C

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	<u>Cmpd.</u>	<u>X</u>	<u>A</u>	<u>R¹</u>	<u>R³</u>	<u>Z</u>	<u>m.p. (°C)</u>
5	10	CN	CR ² (R ² =H)	CO ₂ CH ₃	OCH ₃	N	Oil
	11	CN	CR ² (R ² =H)	CO ₂ Et	OCH ₃	CH	49-50
	16	CN	CR ² (R ² =NO ₂)	CO ₂ CH ₃	OCH ₃	CH	126-128
	17	CO ₂ Et	CR ² (R ² =H)	CH ₃	OCH ₃	CH	Oil
	18	CO ₂ H	CR ² (R ² =H)	CH ₃	OCH ₃	CH	81-84
10	19	CO ₂ Et	CR ² (R ² =H)	H	OCH ₃	CH	Oil
	20	CO ₂ Et	CR ² (R ² =CH ₃)	H	OCH ₃	CH	Oil
	21	CO ₂ Et	CR ² (R ² =F)	H	OCH ₃	CH	Oil
	22	CO ₂ Et	CR ² (R ² =H)	H	CH ₃	N	Oil

15

SPECTRAL DATACompoundData

20	3	PMR(CDCl ₃ , 90MHz) δ 2.35(s, CH ₃ , 3H), 3.9(s, OCH ₃ , 6H), 4.25(s, CH ₂ , 2H), 5.35(s, OCH ₂ , 2H), 5.85(s, pyrMH, 1H), 7.1-7.6(m, ArH, OH).
	10	PMR(CDCl ₃ , 200MHz) δ 3.90(s, CO ₂ CH ₃ , 3H), 4.00(s, OCH ₃ , 6H), 6.99(s, CHCN, 1H), 7.4-8.1(m, ArH, 4H).
	17	PMR(CDCl ₃ , 200MHz) δ 1.35(t, CH ₃ , 3H), 2.54(s, CH ₃ , 3H), 3.96(s, OCH ₃ , 6H), 4.2-4.4(m, CH ₂ O, 2H), 5.49(s, CH, 1H), 6.01(s, pyrMH, 1H), 7.2-7.6(m, ArH, 4H).
30	19	PMR(CDCl ₃ , 200MHz) δ 1.24(t, CH ₃ , 3H), 3.89(s, OCH ₃ , 6H), 5.08(s, CH, 1H), 5.89(s, pyrMH, 1H), 7.2-7.6(m, ArH, 5H).
	20	PMR(CDCl ₃ , 200MHz) δ 1.24(t, CH ₃ , 3H), 2.33(s, CH ₃ , 3H), 3.89(s, OCH ₃ , 6H), 4.1(m, OCH ₂ , 2H), 5.05(s, CH ₂ , 1H), 5.89(s, pyrMH, 1H), 7.1-7.4(m, ArH, 4H).
35		

	<u>Compound</u>	<u>Data</u>
5	21	IR (neat) ν co 1740cm^{-1}
	22	PMR(CDCl_3 , 200MHz) δ 1.23(t, CH_3 , 3H), 2.55(s, CH_3 , 3H), 4.0(s, OCH_3 , 3H), 4.2(q, OCH_2 , 2H), 5.07(s, CH, 1H), 7.2-7.6(m, ArH, 5H).
10	<u>TEST A</u>	
	Seeds of barley (<u>Hordeum vulgare</u>), barnyardgrass (<u>Echinochloa crus-galli</u>), cheatgrass (<u>Bromus secalinus</u>), cocklebur (<u>Xanthium</u> 15 <u>pensylvanicum</u>), corn (<u>Zea mays</u>), cotton (<u>Gossypium</u> <u>hirsutum</u>), crabgrass (<u>Digitaria</u> spp.), bedstraw (<u>Galium aparine</u>), giant foxtail (<u>Setaria faberii</u>), morningglory (<u>Ipomoea hederacea</u>), rice (<u>Oryza</u> <u>sativa</u>), sorghum (<u>Sorghum bicolor</u>), soybean (<u>Glycine</u> 20 <u>max</u>), sugar beet (<u>Beta vulgaris</u>), velvetleaf (<u>Abutilon theophrasti</u>), wheat (<u>Triticum aestivum</u>), wild oat (<u>Avena fatua</u>) and purple nutsedge (<u>Cyperus</u> <u>rotundus</u>) tubers were planted and treated preemergence with test chemicals dissolved in a 25 non-phytotoxic solvent. At the same time, these crop and weed species were also treated with postemergence applications of test chemicals. Plants ranged in height from two to eighteen cm (one to four leaf stage) for postemergence treatments. Treated plants 30 and controls were maintained in a greenhouse for twelve to sixteen days, after which all species were compared to controls and visually evaluated. Plant response ratings, summarized in Table A, are based on a scale of 0 to 10 where 0 is no effect and 10 is 35 complete control. A dash (-) response means no test result.	

Table A

5	COMPOUND			COMPOUND		
	Rate (2000 g/ha)	1	6	Rate (2000 g/ha)	1	6
	POSTEMERGENCE			PREEMERGENCE		
	Barley	9	9	Barley	9	9
10	Barnyardgrass	9	9	Barnyardgrass	9	9
	Cheatgrass	9	9	Cheatgrass	8	8
	Cocklebur	9	-	Cocklebur	9	9
	Corn	9	9	Corn	9	9
	Cotton	10	9	Cotton	8	9
15	Crabgrass	8	7	Crabgrass	8	9
	Giant foxtail	9	9	Giant foxtail	9	9
	Morningglory	9	10	Morningglory	9	9
	Nutsedge	10	10	Nutsedge	10	10
	Rice	9	9	Rice	10	10
20	Sorghum	9	9	Sorghum	9	9
	Soybean	9	9	Soybean	9	9
	Sugar beet	9	10	Sugar beet	9	9
	Velvetleaf	9	10	Velvetleaf	9	9
	Wheat	9	8	Wheat	9	9
25	Wild Oat	9	9	Wild Oat	8	8

Table A

5	COMPOUND		COMPOUND	
	Rate (1000 g/ha)	6	Rate (1000 g/ha)	6
	POSTEMERGENCE		PREEMERGENCE	
	Barley	9	Barley	9
	Barnyardgrass	8	Barnyardgrass	9
10	Cheatgrass	9	Cheatgrass	8
	Cocklebur	10	Cocklebur	9
	Corn	9	Corn	7
	Cotton	9	Cotton	9
	Crabgrass	5	Crabgrass	9
15	Giant foxtail	8	Giant foxtail	9
	Morningglory	10	Morningglory	8
	Nutsedge	-	Nutsedge	10
	Rice	9	Rice	9
	Sorghum	9	Sorghum	9
20	Soybean	9	Soybean	9
	Sugar beet	9	Sugar beet	9
	Velvetleaf	10	Velvetleaf	9
	Wheat	8	Wheat	8
25	Wild Oat	9	Wild Oat	7
30				
35				

Table A

COMPOUND		COMPOUND	
5	Rate (100 g/ha)	6	Rate (100 g/ha)
	POSTEMERGENCE		PREEMERGENCE
	Barley	8	Barley
	Barnyardgrass	4	Barnyardgrass
10	Cheatgrass	8	Cheatgrass
	Cocklebur	9	Cocklebur
	Corn	7	Corn
	Cotton	9	Cotton
	Crabgrass	4	Crabgrass
15	Giant foxtail	5	Giant foxtail
	Morningglory	9	Morningglory
	Nutsedge	9	Nutsedge
	Rice	9	Rice
	Sorghum	9	Sorghum
20	Soybean	9	Soybean
	Sugar beet	9	Sugar beet
	Velvetleaf	9	Velvetleaf
	Wheat	2	Wheat
	Wild Oat	7	Wild Oat

25

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35

Table A

		COMPOUND				COMPOUND			
	5								
		Rate (400 g/ha)	1	2	3	Rate (400 g/ha)	1	2	3
		POSTEMERGENCE				PREEMERGENCE			
		Barley	9	9	8	Barley	8	8	0
		Barnyardgrass	9	9	2	Barnyardgrass	9	9	0
10		Cheatgrass	9	9	8	Cheatgrass	8	9	0
		Cocklebur	9	9	2	Cocklebur	9	8	0
		Corn	9	9	9	Corn	9	9	2
		Cotton	9	3	0	Cotton	8	0	0
		Crabgrass	7	5	0	Crabgrass	7	6	0
15		Giant foxtail	9	9	7	Giant foxtail	9	9	2
		Morningglory	4	2	5	Morningglory	8	4	0
		Nutsedge	10	9	9	Nutsedge	10	10	0
		Rice	9	9	9	Rice	10	10	6
		Sorghum	9	9	8	Sorghum	9	9	3
20		Soybean	9	9	9	Soybean	9	9	3
		Sugar beet	9	10	10	Sugar beet	9	9	8
		Velvetleaf	9	9	7	Velvetleaf	9	9	0
		Wheat	9	8	2	Wheat	8	8	0
		Wild Oat	9	8	6	Wild Oat	7	8	0
25									

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Table A

5	COMPOUND		COMPOUND	
	Rate (50 g/ha)	2 3	Rate (50 g/ha)	2 3
	POSTEMERGENCE		PREEMERGENCE	
	Barley	7 3	Barley	6 0
	Barnyardgrass	1 0	Barnyardgrass	6 0
10	Cheatgrass	9 4	Cheatgrass	7 0
	Cocklebur	7 1	Cocklebur	3 0
	Corn	9 6	Corn	9 0
	Cotton	0 0	Cotton	0 0
	Crabgrass	2 0	Crabgrass	2 0
15	Giant foxtail	7 0	Giant foxtail	8 0
	Morningglory	2 2	Morningglory	4 0
	Nutsedge	5 0	Nutsedge	10 0
	Rice	9 3	Rice	9 2
	Sorghum	9 3	Sorghum	9 0
20	Soybean	9 7	Soybean	6 0
	Sugar beet	9 9	Sugar beet	9 3
	Velvetleaf	9 4	Velvetleaf	7 0
	Wheat	3 0	Wheat	3 0
25	Wild Oat	0 0	Wild Oat	5 0

30

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TEST B

Seeds of barley (Hordeum vulgare),
5 barnyardgrass (Echinochloa crus-galli), bedstraw
(Galium aparine), blackgrass (Alopecurus
myosuroides), cheatgrass (Bromus secalinus),
chickweed (Stellaria media), cocklebur (Xanthium
pensylvanicum), corn (Zea mays), cotton (Gossypium
10 hirsutum), crabgrass (Digitaria spp.), giant foxtail
(Setaria faberii), lambsquarters (Chenopodium album),
morningglory (Ipomoea hederacea), rape (Brassica
napus), rice (Oryza sativa), sorghum (Sorghum
bicolor), soybean (Glycine max), sugar beet (Beta
15 vulgaris), velvetleaf (Abutilon theophrasti), wheat
(Triticum aestivum), wild buckwheat (Polygonum
convolvulus), and wild oat (Avena fatua) and purple
nutsedge (Cyperus rotundus) tubers were planted and
treated preemergence with test chemicals dissolved in
20 a non-phytotoxic solvent. At the same time, these
crop and weed species were also treated with
postemergence applications of test chemicals. Plants
ranged in height from two to eighteen cm (one to four
leaf stage) for postemergence treatments. Treated
25 plants and controls were maintained in a greenhouse
for approximately twelve to sixteen days, after which
all species were compared to controls and visually
evaluated. Plant response ratings, summarized in
Table B, are based on a scale of 0 to 10 where 0 is
30 no effect and 10 is complete control. A dash (-)
response means no test result.

Table B

5	COMPOUND		COMPOUND	
	Rate (2000 g/ha)	9	Rate (2000 g/ha)	9
	POSTEMERGENCE		PREEMERGENCE	
	Barley	7	Barley	7
	Barnyardgrass	2	Barnyardgrass	6
10	Bedstraw	-	Bedstraw	9
	Blackgrass	6	Blackgrass	8
	Cheatgrass	6	Cheatgrass	9
	Chickweed	7	Chickweed	9
	Cocklebur	2	Cocklebur	3
15	Corn	4	Corn	2
	Cotton	9	Cotton	8
	Crabgrass	2	Crabgrass	-
	Giant foxtail	3	Giant foxtail	2
	Lambsquarters	6	Lambsquarters	9
20	Morningglory	4	Morningglory	2
	Nutsedge	9	Nutsedge	-
	Rape	5	Rape	7
	Rice	4	Rice	8
	Sorghum	9	Sorghum	7
25	Soybean	9	Soybean	9
	Sugar beet	9	Sugar beet	9
	Velvetleaf	9	Velvetleaf	8
	Wheat	2	Wheat	2
	Wild Buckwheat	8	Wild Buckwheat	9
30	Wild Oat	2	Wild Oat	7

Table B

5	COMPOUND				COMPOUND			
	Rate (400 g/ha)	4	5	9	Rate (400 g/ha)	4	5	9
	POSTEMERGENCE				PREEMERGENCE			
10	Barley	3	3	2	Barley	0	0	0
	Barnyardgrass	2	0	0	Barnyardgrass	0	0	2
	Bedstraw	9	9	4	Bedstraw	6	8	7
	Blackgrass	0	2	4	Blackgrass	5	4	4
	Cheatgrass	2	5	2	Cheatgrass	0	4	6
15	Chickweed	6	8	6	Chickweed	6	5	9
	Cocklebur	1	6	3	Cocklebur	7	2	2
	Corn	0	0	2	Corn	0	0	-
	Cotton	4	8	6	Cotton	0	5	8
	Crabgrass	0	2	2	Crabgrass	2	0	-
20	Giant foxtail	0	3	2	Giant foxtail	2	2	2
	Lambsquarters	7	8	5	Lambsquarters	10	10	-
	Morningglory	1	6	3	Morningglory	0	2	1
	Nutsedge	5	9	8	Nutsedge	0	9	-
	Rape	3	5	2	Rape	3	3	0
25	Rice	0	5	2	Rice	0	3	2
	Sorghum	3	7	8	Sorghum	0	2	5
	Soybean	9	9	9	Soybean	3	9	8
	Sugar beet	9	9	9	Sugar beet	4	6	9
	Velvetleaf	8	9	7	Velvetleaf	3	8	8
30	Wheat	0	0	0	Wheat	0	0	0
	Wild Buckwheat	9	8	7	Wild Buckwheat	6	3	6
	Wild Oat	0	1	2	Wild Oat	0	2	2

Table B

5	COMPOUND			COMPOUND		
	Rate (100 g/ha)	4	5	Rate (100 g/ha)	4	5
	POSTEMERGENCE			PREEMERGENCE		
	Barley	0	0	Barley	0	0
	Barnyardgrass	0	0	Barnyardgrass	0	0
10	Bedstraw	9	7	Bedstraw	2	7
	Blackgrass	0	0	Blackgrass	3	2
	Cheatgrass	0	2	Cheatgrass	0	2
	Chickweed	4	5	Chickweed	5	4
	Cocklebur	0	2	Cocklebur	5	-
15	Corn	0	0	Corn	0	0
	Cotton	2	7	Cotton	0	0
	Crabgrass	0	0	Crabgrass	0	0
	Giant foxtail	0	0	Giant foxtail	2	2
	Lambsquarters	5	7	Lambsquarters	10	0
20	Morningglory	1	5	Morningglory	0	0
	Nutsedge	2	9	Nutsedge	0	5
	Rape	0	2	Rape	0	2
	Rice	0	3	Rice	0	0
	Sorghum	0	4	Sorghum	0	0
25	Soybean	9	9	Soybean	2	8
	Sugar beet	8	8	Sugar beet	0	1
	Velvetleaf	5	8	Velvetleaf	2	0
	Wheat	0	0	Wheat	0	0
	Wild Buckwheat	8	8	Wild Buckwheat	2	4
30	Wild Oat	0	0	Wild Oat	0	0

Table B

		COMPOUND	
5	Rate (2000 g/ha)	10	16
	POSTEMERGENCE		
	Barley	9	6
	Barnyardgrass	9	6
	Bedstraw	7	9
	Blackgrass	9	8
10	Cheatgrass	9	8
	Chickweed	9	-
	Cocklebur	9	-
	Corn	6	2
	Cotton	9	9
	Crabgrass	7	2
	Giant foxtail	8	8
	Lambsquarters	9	9
15	Morningglory	8	9
	Nutsedge	9	8
	Rape	10	9
	Rice	9	9
	Sorghum	9	9
	Soybean	9	9
	Sugar beet	10	10
20	Velvetleaf	9	9
	Wheat	6	6
	Wild buckwheat	10	9
	Wild oat	5	3

		COMPOUND	
25	Rate (2000 g/ha)	10	16
	PREEMERGENCE		
	Barley	9	0
	Barnyardgrass	8	5
	Bedstraw	7	9
	Blackgrass	9	6
	Cheatgrass	8	8
	Chickweed	10	9
30	Cocklebur	-	-
	Corn	3	1
	Cotton	7	6
	Crabgrass	5	2
	Giant foxtail	7	1
	Lambsquarters	9	9
	Morningglory	5	2
	Nutsedge	5	7
35	Rape	8	9
	Rice	7	9
	Sorghum	8	4
	Soybean	9	9
	Sugar beet	9	9

	Table B	COMPOUND	
5	Velvetleaf	7	6
	Wheat	7	4
	Wild buckwheat	7	9
	Wild oat	6	0

	Table B	COMPOUND	
10	Rate (1000 g/ha)	19	
	POSTEMERGENCE		
	Barley	8	
	Barnyardgrass	9	
	Bedstraw	8	
	Blackgrass	9	
	Cheatgrass	9	
	Chickweed	10	
	Corn	9	
	Cotton	5	
15	Crabgrass	8	
	Giant foxtail	8	
	Lambsquarters	9	
	Morningglory	9	
	Nutsedge	-	
	Rape	9	
20	Rice	9	
	Sorghum	9	
	Soybean	6	
	Sugar beet	10	
	Velvetleaf	5	
	Wheat	8	
	Wild buckwheat	9	
	Wild oat	9	

25	Table B	COMPOUND	
	Rate (1000 g/ha)	19	
	PREEMERGENCE		
30	Barley	7	
	Barnyardgrass	9	
	Bedstraw	9	
	Blackgrass	9	
	Cheatgrass	8	
	Chickweed	9	
	Corn	9	
	Cotton	8	
	Crabgrass	9	
	Giant foxtail	9	
35	Lambsquarters	9	
	Morningglory	5	
	Nutsedge	9	
	Rape	6	
	Rice	9	
	Sorghum	9	

Table B		COMPOUND			
Rate (1000 g/ha)		19			
5	Soybean	8			
	Sugar beet	9			
	Velvetleaf	2			
	Wheat	9			
	Wild buckwheat	8			
	Wild oat	9			
Table B		COMPOUND			
Rate (400 g/ha)		10	11	16	18
10	POSTEMERGENCE				
	Barley	9	0	6	0
15	Barnyardgrass	9	0	3	-
	Bedstraw	7	3	8	2
	Blackgrass	9	0	5	1
	Cheatgrass	8	0	8	0
	Chickweed	9	7	9	3
	Cocklebur	9	-	-	-
	Corn	4	0	0	1
	Cotton	9	5	6	0
	Crabgrass	4	0	0	0
	Giant foxtail	7	0	7	0
20	Lambsquarters	8	8	8	0
	Morningglory	7	3	9	0
	Nutsedge	-	6	7	0
	Rape	9	2	9	0
	Rice	8	2	7	0
	Sorghum	9	0	8	3
	Soybean	9	9	9	0
	Sugar beet	10	9	9	3
	Velvetleaf	9	5	9	0
	Wheat	5	0	2	2
25	Wild buckwheat	9	8	8	0
	Wild oat	3	0	0	0

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Table B

COMPOUND

5	Rate (400 g/ha)	10	11	16	18
	PREEMERGENCE				
	Barley	8	0	0	0
	Barnyardgrass	7	0	3	3
	Bedstraw	2	5	3	0
10	Blackgrass	8	4	0	0
	Cheatgrass	8	3	8	5
	Chickweed	0	6	4	0
	Cocklebur	-	-	-	-
	Corn	2	0	0	0
15	Cotton	6	4	0	0
	Crabgrass	2	0	0	2
	Giant foxtail	3	0	1	2
	Lambsquarters	9	8	9	0
	Morningglory	2	0	0	0
20	Nutsedge	0	0	0	-
	Rape	7	2	3	0
	Rice	6	0	7	2
	Sorghum	7	1	0	9
	Soybean	9	8	6	0
25	Sugar beet	8	2	9	2
	Velvetleaf	3	1	3	1
	Wheat	5	0	2	0
	Wild buckwheat	2	4	3	0
	Wild oat	4	2	0	2

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	Table B	COMPOUND
5	Rate (200 g/ha)	19
	POSTEMERGENCE	
	Barley	5
	Barnyardgrass	8
	Bedstraw	6
10	Blackgrass	7
	Cheatgrass	7
	Chickweed	7
	Cocklebur	-
	Corn	8
15	Cotton	0
	Crabgrass	6
	Giant foxtail	4
	Lambsquarters	9
	Morningglory	1
20	Nutsedge	6
	Rape	7
	Rice	8
	Sorghum	7
	Soybean	4
25	Sugar beet	8
	Velvetleaf	2
	Wheat	2
	Wild buckwheat	7
	Wild Oat	5
30		

Table B COMPOUND

5	Rate (200 g/ha)	12	19
	PREEMERGENCE		
	Barley	9	3
	Barnyardgrass	7	8
	Bedstraw	9	9
10	Blackgrass	3	8
	Cheatgrass	9	8
	Chickweed	10	9
	Cocklebur	-	-
	Corn	1	5
15	Cotton	8	1
	Crabgrass	2	9
	Giant foxtail	2	8
	Lambsquarters	9	10
	Morningglory	9	0
20	Nutsedge	7	5
	Rape	9	6
	Rice	8	6
	Sorghum	8	5
	Soybean	9	2
25	Sugar beet	9	9
	Velvetleaf	9	0
	Wheat	8	7
	Wild buckwheat	9	3
	Wild oat	8	8

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Table B

COMPOUND

5	Rate (100 g/ha)	11	18
	POSTEMERGENCE		
	Barley	0	0
	Barnyardgrass	0	-
	Bedstraw	2	0
10	Blackgrass	0	0
	Cheatgrass	0	0
	Chickweed	0	0
	Cocklebur	-	-
	Corn	0	0
15	Cotton	2	0
	Crabgrass	0	0
	Giant foxtail	0	0
	Lambsquarters	4	0
	Morningglory	1	0
20	Nutsedge	0	0
	Rape	0	0
	Rice	0	0
	Sorghum	0	2
	Soybean	8	0
25	Sugar beet	8	3
	Velvetleaf	0	0
	Wheat	0	0
	Wild buckwheat	7	0
	Wild oat	0	0

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Table B COMPOUND

5	Rate (100 g/ha)	11	18
	PREEMERGENCE		
	Barley	0	0
	Barnyardgrass	0	0
	Bedstraw	0	0
10	Blackgrass	2	0
	Cheatgrass	0	2
	Chickweed	0	0
	Cocklebur	-	-
	Corn	0	0
15	Cotton	0	0
	Crabgrass	0	0
	Giant foxtail	0	0
	Lambsquarters	0	0
	Morningglory	0	0
20	Nutsedge	0	0
	Rape	0	0
	Rice	0	0
	Sorghum	0	3
	Soybean	6	0
25	Sugar beet	0	2
	Velvetleaf	0	0
	Wheat	0	0
	Wild buckwheat	0	0
	Wild oat	0	0

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TEST C

Seeds of barley (Hordeum vulgare),
5 barnyardgrass (Echinochloa crus-galli), blackgrass
(Alopecurus myosuroides), chickweed (Stellaria
media), cocklebur (Xanthium pensylvanicum), corn (Zea
mays), cotton (Gossypium hirsutum), crabgrass
(Digitaria spp.), downy brome (Bromus tectorum),
10 giant foxtail (Setaria faberii), green foxtail
(Setaria viridis), jimsonweed (Datura stramonium),
johnsongrass (Sorghum halepense), lambsquarters
(Chenopodium album), morningglory (Ipomoea spp.),
rape (Brassica napus), rice (Oryza sativa), sicklepod
15 (Cassia obtusifolia), soybean (Glycine max), sugar
beet (Beta vulgaris), teaweed (Sida spinosa),
velvetleaf (Abutilon theophrasti), wheat (Triticum
aestivum), wild buckwheat (Polygonum convolvulus),
and wild oat (Avena fatua) and purple nutsedge
20 (Cyperus rotundus) tubers were planted and treated
preemergence with test chemicals dissolved in a
non-phytotoxic solvent. At the same time, these crop
and weed species were also treated with postemergence
applications of test chemicals. Plants ranged in
25 height from two to eighteen cm (two to three leaf
stage) for postemergence treatments. Treated plants
and controls were maintained in a greenhouse for
approximately eighteen to twenty-four days, after
which all species were compared to controls and
30 visually evaluated. Plant response ratings,
summarized in Table C, are reported on a 0 to 10
scale where 0 is no effect and 10 is complete
control. A dash (-) response means no test result.

Table C

5	COMPOUND		COMPOUND	
	Rate (250 g/ha)	1	Rate (250 g/ha)	1
	POSTEMERGENCE		PREEMERGENCE	
	Barley	8	Barley	7
	Barnyardgrass	9	Barnyardgrass	10
10	Blackgrass	7	Blackgrass	7
	Chickweed	10	Chickweed	9
	Cocklebur	9	Cocklebur	10
	Corn	10	Corn	10
	Cotton	3	Cotton	4
15	Crabgrass	7	Crabgrass	8
	Downy brome	7	Downy brome	8
	Giant foxtail	9	Giant foxtail	7
	Green foxtail	7	Green foxtail	8
	Jimsonweed	9	Jimsonweed	8
20	Johnsongrass	9	Johnsongrass	8
	Lambsquarters	10	Lambsquarters	-
	Morningglory	4	Morningglory	8
	Nutsedge	9	Nutsedge	10
	Rape	9	Rape	10
25	Rice	9	Rice	10
	Sicklepod	8	Sicklepod	8
	Soybean	9	Soybean	8
	Sugar beet	10	Sugar beet	10
	Teaweed	9	Teaweed	9
30	Velvetleaf	10	Velvetleaf	9
	Wheat	6	Wheat	6
	Wild buckwheat	10	Wild buckwheat	9
	Wild oat	7	Wild oat	7
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Table C

5	COMPOUND		COMPOUND
	Rate (62 g/ha)	1 6	Rate (62 g/ha)
	POSTEMERGENCE		PREEMERGENCE
	Barley	5 5	Barley
	Barnyardgrass	9 8	Barnyardgrass
10	Blackgrass	7 3	Blackgrass
	Chickweed	10 10	Chickweed
	Cocklebur	7 8	Cocklebur
	Corn	10 3	Corn
	Cotton	2 9	Cotton
15	Crabgrass	6 2	Crabgrass
	Downy brome	5 7	Downy brome
	Giant foxtail	8 4	Giant foxtail
	Green foxtail	4 4	Green foxtail
	Jimsonweed	9 8	Jimsonweed
20	Johnsongrass	7 8	Johnsongrass
	Lambsquarters	- 10	Lambsquarters
	Morningglory	0 9	Morningglory
	Nutsedge	9 3	Nutsedge
	Rape	8 10	Rape
25	Rice	9 7	Rice
	Sicklepod	8 6	Sicklepod
	Soybean	8 9	Soybean
	Sugar beet	10 10	Sugar beet
	Teaweed	8 9	Teaweed
30	Velvetleaf	10 9	Velvetleaf
	Wheat	4 3	Wheat
	Wild buckwheat	9 9	Wild buckwheat
	Wild oat	4 4	Wild oat

Table C

5	COMPOUND		COMPOUND	
	Rate (16 g/ha)	1 6	Rate (16 g/ha)	1 6
	POSTEMERGENCE		PREEMERGENCE	
	Barley	4 2	Barley	3 2
	Barnyardgrass	4 4	Barnyardgrass	6 4
10	Blackgrass	6 0	Blackgrass	4 0
	Chickweed	6 8	Chickweed	5 0
	Cocklebur	2 5	Cocklebur	9 3
	Corn	9 3	Corn	4 0
	Cotton	0 8	Cotton	3 9
15	Crabgrass	3 0	Crabgrass	5 0
	Downy brome	4 5	Downy brome	6 7
	Giant foxtail	4 2	Giant foxtail	0 0
	Green foxtail	2 2	Green foxtail	3 0
	Jimsonweed	7 5	Jimsonweed	6 9
20	Johnsongrass	6 7	Johnsongrass	6 8
	Lambsquarters	9 10	Lambsquarters	- 3
	Morningglory	0 9	Morningglory	6 9
	Nutsedge	4 2	Nutsedge	5 3
	Rape	6 9	Rape	8 0
25	Rice	8 5	Rice	8 0
	Sicklepod	4 5	Sicklepod	6 6
	Soybean	6 8	Soybean	4 9
	Sugar beet	10 9	Sugar beet	9 8
	Teaweed	6 7	Teaweed	9 9
30	Velvetleaf	8 9	Velvetleaf	9 0
	Wheat	2 2	Wheat	3 2
	Wild buckwheat	9 8	Wild buckwheat	7 8
	Wild oat	2 2	Wild oat	3 2

Table C

5	COMPOUND		COMPOUND	COMPOUND	
	Rate (4 g/ha)	1 6		Rate (4 g/ha)	1 6
	POSTEMERGENCE			PREEMERGENCE	
	Barley	2 0		Barley	0 0
	Barnyardgrass	2 0		Barnyardgrass	3 3
10	Blackgrass	4 0		Blackgrass	4 0
	Chickweed	4 7		Chickweed	3 0
	Cocklebur	0 5		Cocklebur	7 0
	Corn	5 0		Corn	2 0
	Cotton	0 8		Cotton	0 -
15	Crabgrass	0 0		Crabgrass	3 0
	Downy brome	3 3		Downy brome	4 2
	Giant foxtail	1 0		Giant foxtail	0 0
	Green foxtail	2 0		Green foxtail	3 0
	Jimsonweed	5 5		Jimsonweed	3 9
20	Johnsongrass	3 4		Johnsongrass	4 5
	Lambsquarters	8 8		Lambsquarters	- 0
	Morningglory	0 8		Morningglory	- 5
	Nutsedge	4 0		Nutsedge	3 0
	Rape	5 7		Rape	7 0
25	Rice	7 3		Rice	4 0
	Sicklepod	4 4		Sicklepod	5 4
	Soybean	4 6		Soybean	3 8
	Sugar beet	10 9		Sugar beet	8 3
	Teaweed	4 5		Teaweed	8 8
30	Velvetleaf	7 7		Velvetleaf	8 0
	Wheat	0 0		Wheat	0 0
	Wild buckwheat	7 6		Wild buckwheat	6 2
	Wild oat	0 0		Wild oat	0 0

TEST D

The compound evaluated in this test was formulated in a non-phytoxic solvent and applied to the soil surface before plant seedlings emerged (preemergence application), to water that covered the soil surface (paddy application), and to plants that were in the one-to-four leaf stage (postemergence application). A sandy loam soil was used for the preemergence and postemergence tests, while a silt loam soil was used in the paddy test. Water depth was approximately 2.5 cm for the paddy test and was maintained at this level for the duration of the test.

Plant species in the preemergence and postemergence tests consisted of barley (Hordeum vulgare), bedstraw (Galium aparine), blackgrass (Alopecurus myosuroides), chickweed (Stellaria media), corn (Zea mays), cotton (Gossypium hirsutum), crabgrass (Digitaria sanguinalis), downy brome (Bromus tectorum), giant foxtail (Setaria faberii), lambsquarters (Chenopodium album), morningglory (Ipomoea hederacea), pigweed (Amaranthus retroflexus), rape (Brassica napus), ryegrass (Lolium multiflorum), sorghum (Sorghum bicolor), soybean (Glycine max), speedwell (Veronica persica), sugar beet (Beta vulgaris), velvetleaf (Abutilon theophrasti), wheat (Triticum aestivum), wild buckwheat (Polygonum convolvulus), and wild oat (Avena fatua). All plant species were planted one day before application of the compound for the preemergence portion of this test. Plantings of these species were adjusted to produce plants of appropriate size for the postemergence portion of the test. Plant species in the paddy test consisted of barnyardgrass (Echinochloa crus-galli), rice (Oryza sativa), and umbrella sedge (Cyperus difformis).

5 All plant species were grown using normal
greenhouse practices. Visual evaluations of injury
expressed on treated plants, when compared to
untreated controls, were recorded approximately
fourteen to twenty-one days after application of the
test compound. Plant response ratings, summarized in
Table D, were recorded on a zero to ten scale where
10 zero is no injury and ten is plant death. A dash (-)
response means no test result.

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Table D

5	COMPOUND		COMPOUND	
	Rate (500 g/ha)	2	Rate (500 g/ha)	2
	POSTEMERGENCE		PADDY	
	Barley	10	Barnyardgrass	8
	Bedstraw	10	Rice	8
10	Blackgrass	10	Umbrella sedge	9
	Chickweed	10		
	Corn	10		
	Cotton	6		
	Crabgrass	4		
15	Downy brome	9		
	Giant foxtail	9		
	Lambsquarters	10		
	Morningglory	6		
	Pigweed	10		
20	Rape	9		
	Ryegrass	7		
	Sorghum	7		
	Soybean	10		
	Speedwell	10		
25	Sugar beet	10		
	Velvetleaf	10		
	Wheat	8		
	Wild buckwheat	10		
30	Wild oat	8		

Table D

5	COMPOUND		COMPOUND	
	Rate (500 g/ha)	2	Rate (250 g/ha)	2
	PREEMERGENCE		POSTEMERGENCE	
	Barley	8	Barley	10
	Bedstraw	9	Bedstraw	10
10	Blackgrass	7	Blackgrass	10
	Chickweed	9	Chickweed	10
	Corn	10	Corn	10
	Cotton	5	Cotton	4
	Crabgrass	8	Crabgrass	3
15	Downy brome	8	Downy brome	9
	Giant foxtail	9	Giant foxtail	9
	Lambsquarters	9	Lambsquarters	10
	Morningglory	8	Morningglory	4
	Pigweed	10	Pigweed	10
20	Rape	9	Rape	8
	Ryegrass	9	Ryegrass	-
	Sorghum	10	Sorghum	7
	Soybean	9	Soybean	10
	Speedwell	9	Speedwell	10
25	Sugar beet	9	Sugar beet	10
	Velvetleaf	9	Velvetleaf	10
	Wheat	8	Wheat	8
	Wild buckwheat	9	Wild buckwheat	10
30	Wild oat	7	Wild oat	6

Table D

5	COMPOUND		COMPOUND	
	Rate (250 g/ha)	2	Rate (250 g/ha)	2
	PADDY		PREEMERGENCE	
	Barnyardgrass	7	Barley	8
	Rice	8	Bedstraw	9
10	Umbrella sedge	9	Blackgrass	6
			Chickweed	9
			Corn	9
			Cotton	4
15			Crabgrass	8
			Downy brome	8
			Giant foxtail	8
			Lambsquarters	9
			Morningglory	7
20			Pigweed	10
			Rape	9
			Ryegrass	8
			Sorghum	10
			Soybean	9
25			Speedwell	9
			Sugar beet	9
			Velvetleaf	9
			Wheat	7
			Wild buckwheat	9
30			Wild oat	7

Table D

5	COMPOUND		COMPOUND	
	Rate (125 g/ha)	2	Rate (125 g/ha)	2
	POSTEMERGENCE		PADDY	
	Barley	9	Barnyardgrass	7
10	Bedstraw	10	Rice	8
	Blackgrass	9	Umbrella sedge	9
	Chickweed	10		
	Corn	7		
	Cotton	4		
	Crabgrass	0		
15	Downy brome	9		
	Giant foxtail	7		
	Lambsquarters	10		
	Morningglory	2		
	Pigweed	10		
20	Rape	6		
	Ryegrass	7		
	Sorghum	6		
	Soybean	10		
	Speedwell	10		
25	Sugar beet	10		
	Velvetleaf	10		
	Wheat	7		
	Wild buckwheat	10		
30	Wild oat	5		

Table D

5	COMPOUND		COMPOUND	
	Rate (125 g/ha)	2	Rate (62 g/ha)	2
	PREEMERGENCE		POSTEMERGENCE	
	Barley	7	Barley	8
	Bedstraw	9	Bedstraw	10
10	Blackgrass	6	Blackgrass	9
	Chickweed	9	Chickweed	10
	Corn	9	Corn	6
	Cotton	2	Cotton	2
	Crabgrass	7	Crabgrass	0
15	Downy brome	7	Downy brome	8
	Giant foxtail	7	Giant foxtail	6
	Lambsquarters	9	Lambsquarters	10
	Morningglory	7	Morningglory	0
	Pigweed	10	Pigweed	10
20	Rape	8	Rape	5
	Ryegrass	8	Ryegrass	6
	Sorghum	10	Sorghum	6
	Soybean	8	Soybean	10
	Speedwell	9	Speedwell	10
25	Sugar beet	9	Sugar beet	9
	Velvetleaf	8	Velvetleaf	10
	Wheat	7	Wheat	6
	Wild buckwheat	9	Wild buckwheat	10
30	Wild oat	6	Wild oat	4

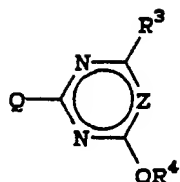
Table D

5	COMPOUND		COMPOUND	
	Rate (62 g/ha)	2	Rate (62 g/ha)	2
	PADDY		PREEMERGENCE	
	Barnyardgrass	7	Barley	6
10	Rice	8	Bedstraw	9
	Umbrella sedge	8	Blackgrass	5
			Chickweed	8
			Corn	8
			Cotton	0
15			Crabgrass	5
			Downy brome	7
			Giant foxtail	6
			Lambsquarters	9
			Morningglory	7
20			Pigweed	10
			Rape	8
			Ryegrass	7
			Sorghum	9
			Soybean	8
25			Speedwell	9
			Sugar beet	8
			Velvetleaf	8
			Wheat	4
			Wild buckwheat	9
30			Wild oat	5
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CLAIMS

5 What is claimed:

1. A compound of the formula:



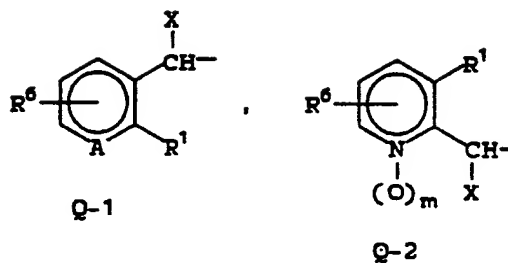
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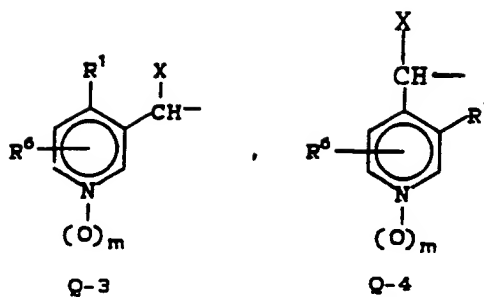


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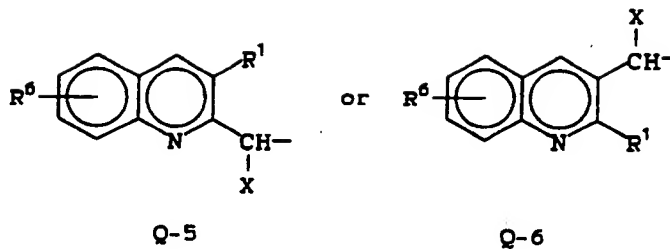
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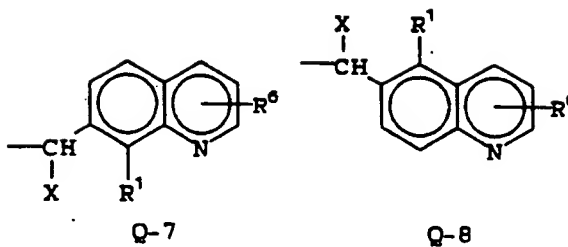
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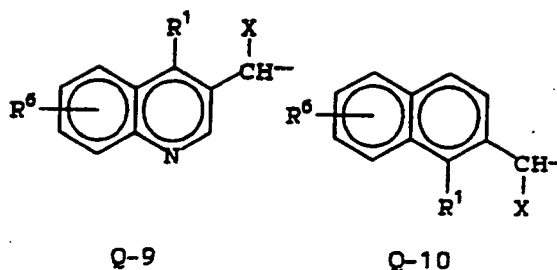
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- A is CR^2 , N or N-O;
- X is H, F, Cl, CH_3 , OH, $C(O)NR^{12}R^{13}$, CO_2R^{14} or CN;
- R^1 is H, CHO, $C(OCH_3)_2H$, CO_2R^5 or $C(O)SR^{11}$;
- R^2 is H, F, Cl, C_1-C_2 alkyl, C_1-C_2 -alkoxy, C_2-C_3 alkynyl, C_2-C_3 alkenyl, $S(O)_n C_1-C_2$ alkyl, NO_2 , phenoxy, C_2-C_4 alkylcarbonyl, $C(OCH_3)_2CH_3$, or $C(SCH_3)_2CH_3$;
- R^3 is C_1-C_2 alkyl, C_1-C_2 alkoxy, OCF_2H or Cl;
- R^4 is C_1-C_2 alkyl;
- R^5 is H; M; C_1-C_3 alkyl; C_2-C_3 haloalkyl; allyl; propargyl; benzyl optionally substituted with halogen, C_1-C_2 alkyl, C_1-C_2 alkoxy, CF_3 , NO_2 , SCH_3 , $S(O)CH_3$, or $S(O)_2CH_3$; C_2-C_4 alkoxyalkyl; $N=CR^7R^8$; or $CHR^9S(O)_nR^{10}$;
- R^6 is H, F, Cl, CH_3 , OCH_3 or $S(O)_nCH_3$;
- R^7 is Cl, C_1-C_2 alkyl or SCH_3 ;

- R^8 is C_1-C_2 alkyl, $CO_2(C_1-C_2$ alkyl) or $C(O)N(CH_3)_2$;
5 R^9 is H or CH_3 ;
 R^{10} is C_1-C_3 alkyl or phenyl optionally substituted with halogen, CH_3 , OCH_3 or NO_2 ;
 R^{11} is C_1-C_2 alkyl or benzyl;
 R^{12} is H or CH_3 ;
10 R^{13} is H or CH_3 ;
 R^{14} is H, C_1-C_3 alkyl, C_2-C_5 haloalkyl, C_3-C_5 alkenyl, C_3-C_5 alkynyl, C_2-C_5 alkoxyalkyl or benzyl optionally substituted with CH_3 , OCH_3 , SCH_3 , halogen, NO_2 or CF_3 ;
15 m is 0 or 1;
 n is 0, 1 or 2;
 M is a alkali metal atom or an alkaline earth metal atom, an ammonium group or an alkylammonium group; and
20 Z is CH or N.
and their agriculturally suitable salts;
provided that:
(a) when R^1 is H, then X is CO_2R^{14} ;
(b) when X is CO_2R^{14} , then R^1 is H; and.
25 (c) when Z is N, then R^3 is C_1-C_2 alkyl or C_1-C_2 alkoxy.

2. The compounds of Claim 1 wherein Q is Q-1 or Q-2.

30 3. The compounds of Claim 2 wherein R^2 is H, F, Cl, CH_3 , SCH_3 , OCH_3 or OCH_2CH_3 .

4. The compounds of Claim 3 wherein
R⁶ is H;
5 Z is CH;
R³ is OCH₃;
R⁴ is CH₃; and
X is H.
- 10 5. The compounds of Claim 3 wherein
R⁶ is H or 3-F;
Z is CH;
R³ is OCH₃;
R⁴ is CH₃;
15 X is CO₂R¹⁴; and
R¹⁴ is C₁-C₃ alkyl, allyl, propargyl or
benzyl.
- 20 6. The compound of Claim 3 which is
2-[cyano(4,6-dimethoxy-2-pyrimidinyl)methyl]-benzoic
acid.
7. The compounds of Claim 4 wherein
Q is Q-1;
25 R¹ is CO₂R⁵; and
R⁵ is H or M.
8. The compounds of Claim 4 wherein
Q is Q-2;
30 R¹ is CO₂R⁵; and
R⁵ is H or M.
9. The compound of Claim 5 which is ethyl
4,6-dimethoxy- α -phenyl-2-pyrimidineacetate.
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10. The compound of Claim 7 which is
2-[(4,6-dimethoxy-2-pyrimidinyl)methyl]-6-methyl-
5 benzoic acid.

11. The compound of Claim 7 which is
2-[(4,6-dimethoxy-2-pyrimidinyl)methyl]-6-methyl
benzoic acid, sodium salt.
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12. The compound of Claim 7 which is
2-[(4,6-dimethoxy-2-pyrimidinyl)methyl]-3-pyridine
carboxylic acid.

13. A composition suitable for controlling
the growth of undesired vegetation which comprises an
effective amount of a compound of Claim 1 and at
least one of the following: surfactant, solid or
liquid diluent.
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14. A composition suitable for controlling
the growth of undesired vegetation which compresses
an effective amount of a compound of Claim 2 and at
least one of the following: surfactant, solid or
25 liquid diluent.

15. A composition suitable for controlling
the growth of undesired vegetation which compresses
an effective amount of a compound of Claim 3 and at
least one of the following: surfactant, solid or
30 liquid diluent.

16. A composition suitable for controlling
the growth of undesired vegetation which compresses
35 an effective amount of a compound of Claim 4 and at

least one of the following: surfactant, solid or liquid diluent.

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17. A composition suitable for controlling the growth of undesired vegetation which compresses an effective amount of a compound of Claim 5 and at least one of the following: surfactant, solid or liquid diluent.

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18. A composition suitable for controlling the growth of undesired vegetation which compresses an effective amount of a compound of Claim 6 and at least one of the following: surfactant, solid or liquid diluent.

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19. A composition suitable for controlling the growth of undesired vegetation which compresses an effective amount of a compound of Claim 7 and at least one of the following: surfactant, solid or liquid diluent.

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20. A composition suitable for controlling the growth of undesired vegetation which compresses an effective amount of a compound of Claim 8 and at least one of the following: surfactant, solid or liquid diluent.

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21. A composition suitable for controlling the growth of undesired vegetation which compresses an effective amount of a compound of Claim 9 and at least one of the following: surfactant, solid or liquid diluent.

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22. A composition suitable for controlling the growth of undesired vegetation which compresses an effective amount of a compound of Claim 10 and at least one of the following: surfactant, solid or liquid diluent.

23. A composition suitable for controlling the growth of undesired vegetation which compresses an effective amount of a compound of Claim 11 and at least one of the following: surfactant, solid or liquid diluent.

24. A composition suitable for controlling the growth of undesired vegetation which compresses an effective amount of a compound of Claim 12 and at least one of the following: surfactant, solid or liquid diluent.

25. A method for controlling the growth of undesired vegetation which compresses applying to the locus to be protected an effective amount of a compound of Claim 1.

26. A method for controlling the growth of undesired vegetation which compresses applying to the locus to be protected an effective amount of a compound of Claim 2.

27. A method for controlling the growth of undesired vegetation which compresses applying to the locus to be protected an effective amount of a compound of Claim 3.

28. A method for controlling the growth of
undesired vegetation which compresses applying to the
5 locus to be protected an effective amount of a
compound of Claim 4.

29. A method for controlling the growth of
undesired vegetation which compresses applying to the
10 locus to be protected an effective amount of a
compound of Claim 5.

30. A method for controlling the growth of
undesired vegetation which compresses applying to the
15 locus to be protected an effective amount of a
compound of Claim 6.

31. A method for controlling the growth of
undesired vegetation which compresses applying to the
20 locus to be protected an effective amount of a
compound of Claim 7.

32. A method for controlling the growth of
undesired vegetation which compresses applying to the
25 locus to be protected an effective amount of a
compound of Claim 8.

33. A method for controlling the growth of
undesired vegetation which compresses applying to the
30 locus to be protected an effective amount of a
compound of Claim 9.

34. A method for controlling the growth of
undesired vegetation which compresses applying to the
35 locus to be protected an effective amount of a
compound of Claim 10.

35. A method for controlling the growth of
undesired vegetation which compresses applying to the
5 locus to be protected an effective amount of a
compound of Claim 11.

36. A method for controlling the growth of
undesired vegetation which compresses applying to the
10 locus to be protected an effective amount of a
compound of Claim 12.

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INTERNATIONAL SEARCH REPORT

International Application No

PCT/US 90/07417

I. CLASSIFICATION OF SUBJECT MATTER (If several classification symbols apply, indicate all) ⁶
 According to International Patent Classification (IPC) or to both National Classification and IPC
 IPC⁵: C 07 D 239/52, C 07 D 251/20, C 07 D 401/06, A 01 N 43/54,
 A 01 N 43/66

II. FIELDS SEARCHED

Minimum Documentation Searched ⁷

Classification System

Classification Symbols

IPC⁵

C 07 D 239/00, C 07 D 251/00, C 07 D 406/00, A 01 N

Documentation Searched other than Minimum Documentation
 to the Extent that such Documents are Included in the Fields Searched ⁸

III. DOCUMENTS CONSIDERED TO BE RELEVANT⁹

Category ¹⁰	Citation of Document, ¹¹ with indication, where appropriate, of the relevant passages ¹²	Relevant to Claim No. ¹³
A	GB, A, 1 585 950 (ICI) 11 March 1981 (11.03.81), see claims 1, 12, 14; compounds No. 106-113. --	1, 13, 25
P, A	EP, A2, 0 360 163 (BASF) 28 March 1990 (28.03.90), see claims 1, 5, 8 (cited in the application). --	1, 13, 25
A	DE, A1, 2 656 183 (AKZO) 23 June 1977 (23.06.77), see claim 2. ----	1

¹⁰ Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"Z" document member of the same patent family

IV. CERTIFICATION

Date of the Actual Completion of the International Search

03 April 1991

Date of Mailing of this International Search Report

17 MAY 1991

International Searching Authority

EUROPEAN PATENT OFFICE

Signature of Authorized Officer

MISS D. S. KOWALCZYK

ANHANG
zum internationalen Recherchen-
bericht über die internationale
Patentanmeldung Nr.

ANNEX
to the International Search
Report to the International Patent
Application No.

ANNEXE
au rapport de recherche inter-
national relatif à la demande de brevet
international n°

544312

In diesem Anhang sind die Mitglieder
der Patentfamilien der im obenge-
nannten internationalen Recherchenbericht
angeführten Patentdokumente angegeben.
Diese Angaben dienen nur zur Unter-
richtung und erfolgen ohne Gewähr.

This Annex lists the patent family
members relating to the patent documents
cited in the above-mentioned inter-
national search report. The Office is
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La présente annexe indique les
membres de la famille de brevets
relatifs aux documents de brevets cités
dans le rapport de recherche inter-
national visée ci-dessus. Les renseigne-
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tif et n'engagent pas la responsabilité
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